FOUNDRY TRADE JOURNAL

Established 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 84 Thursday, April 8, 1948 No. 1649

49, Wellington Street, London, W.C.2

'Grams: "Zacatecas, Rand, London"

'Phone: Temple Bar 3951 (Private Branch Exchange)

PUBLISHED WEEKLY: 21s. per annum (Home and Overseas)

How Foundries now Develop

Though capital expenditure on new plant or extensions to buildings is frowned upon by the Government, yet there is a recognition that circumstances may be such, for the sake of added production or economy in manufacture, that monetary outlay is inevitable. So far as ironfounding is concerned, and where the scheme envisaged involves a cost exceeding £2,000, the procedure is as follows: The applicant prepares his case, reinforcing it with facts and figures designed to show ultimate increased production and lowered cost. This then goes before a Steering Committee of the Council of Ironfoundry Associations. There are several of these, each confining its attention to one area. The personnel, which is drawn from the region covered, is made up of well-known ironfounders. As there is quite a technique in the presentation of these cases, members of the affiliated bodies are advised to get the help of the C.F.A. staff. Once the scheme is passed by the Steering Committee, it then goes back and forth to various Iron and Steel Control committees and other Government bodies, until a permit reaches the applicant from the Regional Licensing Office of the Ministry of Works.

We always imagined that Steering Committees had something to do with the preparation of agenda and the like, but these Steering Committees apparently do steer the various proposals through the maze of Government committees. A number of ironfounders have told us that, though they have to appear before those who may seem to be business competitors, they have warmly appreciated the help given. So far, there have been no cases of "turning down" by the Steering Committee and a later reversal by the "higher-ups." This could happen but, should it occur, the applicant should, by the general experience of others, be convinced that the committees have acted in the best interests of the industry. The alternative to the industry committee would be just one or several more of Government committees replete with technical advisers and red tape. The theoretical disadvantages of the existing scheme are as obvious as the advantages are obscure. Nevertheless, advantages exist. Primarily, though there are many hundreds of ironfoundries, each unit has only a handful of competitors in its own district. One of the persons serving on a committee may or may not be so designated, but the balance most certainly cannot by any stretch of the imagination enter such a category. Yet these men are obviously capable of giving excellent advice drawn from their own experience. It is not unusual for the applicant's foundry to be visited and for valuable suggestions to be made. Then the onus of the actual "steering" is alleviated, as much of this is taken over by the C.F.A.

We understand that any ironfoundry can spend up to £2,000 on new plant each year without going through this procedure. It is a matter for regret that complete freedom to expand is at the moment denied, but, all things considered, this co-operative method now in being is not too bad. At least it gives everybody a double assurance that the money is being well spent!

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The Iron and Steel Institute

Annual General Meeting

The annual general meeting of the Institute will be held on May 5 and 6 in the Lecture Hall of the Royal Institution of Chartered Surveyors, 12, Great George Street, London, S.W.1. A buffet luncheon will be available in the Institution's Arbitration Room on the Wednesday.

The Third Hatfield Memorial Lecture will, by agreement with Sheffield University, be delivered by Prof. Robert F. Mehl (Carnegie Institute of Technology, Pittsburgh, Pa., U.S.A.) in the Lecture Hall of the Royal Institution of Chartered Surveyors on Wednesday, May 5, at 8.30 p.m. A members' luncheon will be held at the Dorchester Hotel, Park Lane, London, W.1, on Thursday, May 6, at 12.45 p.m. for 1.15 p.m. Members and their guests are requested to use the ballroom entrance.

The following is an abridged programme:—

WEDNESDAY, MAY 5

9.45 a.m.: Formal business. Presentation of the Bessemer Gold Medal for 1948 to Mr. W. J. Dawson, C.B.E., in recognition of his contributions to the development of steel castings and to the production of alloy and heat-resisting steels. Presentation of the Sir Robert Hadfield Medal for 1948 to Mr. A. Preece, in recognition of his researches on the scaling and on the overheating and burning of steel. Presentation of the Williams Prize for 1947 to Mr. R. Fowler for his Paper on "Blowing-out a Blast Furnace." Induction of President-eleot, Sir Andrew McCance, D.Sc., F.R.S., and presidential address. Joint discussion on:—"Construction and Repair of Open-hearth Furnaces," by D. C. Muir; "The Design of Open-hearth Gas Ports," by M. P. Newby, and "Installation and Use of Instruments on Open-hearth Melting Furnaces," by R. C. Baker.

1.15 p.m.: Buffet luncheon in the Arbitration Room of the Royal Institution of Chartered Surveyors (tickets 6s. each).

2.30 p.m.: Afternoon session. Joint discussion on: "The Production of Nodular Graphite Structures in Cast Irons," by H. Morrogh and W. J. Williams, and "The Carbides in Iron-carbon-silicon Alloys and Cast Irons," by D. Marles.

3.45 p.m.: Joint discussion on: "Abnormal Creep in Carbon Steels," by J. Glen, and "The Creep Properties of Molybdenum, Chromium-molybdenum and Molybdenum-vanadium Steels," by J. Glen.

8.30 p.m.: Third Hatfield Memorial Lecture, at the Royal Institution of Chartered Surveyors. Prof. Robert F. Mehl (Carnegie Institute of Technology, Pittsburgh, Pa., U.S.A.) will give a lecture on "The Decomposition of Austenite by Nucleation and Growth Processes."

THURSDAY, MAY 6

9.30 a.m. to 12.0 p.m.: Morning session at the Royal Institution of Chartered Surveyors. Joint discussion on: "A Micro-examination of Eight Steels for the Inclusions Sub-committee," by J. H. Whiteley; "The Study of Segregations and Inclusions in Steel by Micro-Radiography," by W. Betteridge and R. S. Sharpe, and "Some Thermodynamical Aspects of the Formation of Inclusions in Mild-steel Weld Metal," by E. C. Rollason and E. Bishop.

10.45 a.m.: Joint discussion on: "A Comparison of Moulds of Standard Composition and of Approximately Ingot Mould Sub-committee Composition," by W. L. Kerlie; "Mould-weight/Ingot-weight Ratio and its Relation to Mould Consumption," by N. H. Bacon, and "Formation of 'Double Skin' or 'Curtaining' on Top-poured Mild-steel Ingots," by P. Walker.

12.45 p.m.: Members' luncheon at the Dorchester Hotel (tickets 25s. each).

The Purchase Tax

The Commissioners of Customs and Excise have sent us Notices No. 78 and 78c. The former covers "Goods Chargeable with Purchase Tax" and the latter "Purchase Tax as applied to Stationery and Office Requisites and Other Paper Manufactures." They are obtainable from City Gate House, 39-45, Finsbury Square, London, E.C.2. The tradesman who has our greatest sympathy is the ironmonger. He has to remember that keys are tax free but key-rings are chargeable at 50 per cent. Metal piping is also free, unless it happens to be a curtain rod. Enamelled hardware used in the preparation or serving of food is tax free, but if it is used for other domestic purposes it carries a 33⅓ per cent. tax, and so forth.

The purchase tax which we personally disliked the most is that imposed on toilet requisites such as tooth paste, and the like. The amazing feature of this and analogous publications is the revelation of the colossal task imposed upon civil servants for them to acquire a knowledge of every branch of manufacture and trade, to consult with their organisations, and then to put their conclusions in legal language. If only all these efforts and the obvious erudition displayed could be directed towards productive effort, we should surely, to use an Americanism, "get places."

The foregoing was written before the Budget speech. To-day the obvious comment is why publish such a pamphlet when there is the probability of changes in the offing? It is just one more example of the waste of public money.

THE 1948 CONGRESS AND EXHIBITION of the American Foundrymen's Association to be held in Philadelphia during the week of May 3, is expected to attract an attendance of about 18,000 visitors. The technical programme embraces more than 60 sessions.

Amongst British visitors, we have heard that the following are making efforts to be present: Mr. P. H. Wilson, the president of the Institute; Mr. E. Longden, who is giving the official British Exchange Paper; Mr. R. L. Hanley, of Ferranti, Mr. F. H. Hoult, of Doncaster, Mr. W. A. Gibson, Foundry Consultant, Sydney, Australia, and Mr. D. Sharpe, past-president of the Institute of British Foundrymen.

The index for the FOUNDRY TRADE JOURNAL, Volume 83, September to December, 1947, is now available, and early application should be made to 49, Wellington Street, London, W.C.2, to secure a copy.

Recent Technical Developments in the Production of Iron Castings*

Report includes Nodular Iron, Cleaning, Substitute Materials, and Di-electric loss heating

By E. C. Dickinson, M.Met., F.I.M., A.M.I.Mech.E.†

Introduction

During the long history of the development of the art of making iron castings there have been periods of activity alternating with long periods of stagnation, but in recent years the foundry industry has received a wealth of new knowledge, and at no time in the past has progress been so marked and sustained as during the present century.

Mechanisation has been applied to the foundry to speed up production, to minimise the manpower required per ton output. and to improve conditions under which the operators work.

Improvements in mechanical plant such as conveyors, moulding machines, core blowers, core stoves, etc., have kept pace with the requirements of mechanisation.

It is the purpose of this Paper, however, to confine attention to foundry processes and to review briefly a few of the technical developments which contribute or promise to contribute to improvements of the product, or of the methods of manufacture, and thereby increase the economic value and efficiency of the industry at this time when the maximum output and the highest quality of iron castings are so urgently needed.

Sources of New Knowledge

New knowledge comes to the industry in many ways, some by direct objective research work, undertaken specifically for the improvement of iron castings, some is the result of research or development in pure science or in other industries which is applicable to foundry work.

Another group of developments arise from the necessity of meeting shortages of manufacturing materials or other economic conditions which demand the provision of substitutes or temporary expedients to maintain production under abnormal circumstances.

In addition there are processes of which there was some technical knowledge in the past, but which have recently been developed by using quantity production methods. Processes of this kind hardly fall within the scope of this Paper, but they are full of interest, and in passing we may mention the investment process which is developed from the "lost wax" method used many centuries ago for making fine art castings, such as silver statuettes. To-day many components of complicated design are cast to such a high degree of dimensional accuracy that difficult machining operations can be eliminated, thus justifying the application of the comparatively costly investment process on a mass production basis.[1]

In their paper before the last Nottingham Conference of the Institute of British Foundrymen, Pollard, Redshaw and Payne[2] described a modern plant for the production of iron castings in permanent cast iron moulds, at high rates of production. The process of casting grey iron in permanent moulds has been known for many years, but it has not hitherto been used very extensively in this country. A great deal of development work has been done on metal analysis, die design, mechanisation and technique, to ensure the present smooth running and high rate of production.

The processes and developments mentioned below are contributing to improvements in the quality of castings and to the reduction in cost of the finished product, for which the industry is continually striving. They have limitations which confine their usefulness to certain spheres of foundry work, but no foundryman can afford to ignore their influence on his own product, and their value to him should be carefully examined.

Nodular Graphite

The process which promises to have the most outstanding influence on the future development of iron castings, and which virtually offers the engineer a new material, is the British Cast Iron Research Association's discovery of the means of producing nodular graphite in the as-cast state. This is the result of years of progressive work and of a determined policy, and it is a signal reward of true research, the logical development of original thought.

Work on the formation of graphite was originally undertaken for the Association by Norbury and Morgan[3] and later by Morrogh and Williams.[4] The gradual accumulation of knowledge of this subject lead to the discovery under review.

Influence of Graphite

Graphite has a very marked effect on cast iron. If it were possible to remove the graphite from normal grey iron, leaving only the matrix, it would yield a steel casting with a carbon content of between 0.2 and 0.9 per cent., alloyed with 1 to 4 per cent. silicon, 0.3 to 1.5 per cent. manganese, 0.03 to 0.12 per cent. sulphur, and 0.03 to 1.5 per cent. of phosphorus. The physical properties which could be expected from this steel are, however, heavily masked in cast iron by the influence of the familiar flakes of graphite, which have in themselves no appreciable strength. When cast iron is stressed, intense local stresses develop at the edges of the flakes, so that if a cast-iron test-piece is stressed at a load below the elastic limit of the matrix, local stresses at the edges of the graphite flakes may exceed the elastic limit, and give rise to

* A paper read before the Lincoln Section of East Midlands Branch of the Institute of British Foundrymen, Mr. E. A. Phillips presiding.

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local distortion or strain. Cast iron does not, for this reason, appear to follow Hooke's law, and rarely, if ever, shows any definite straight line at the beginning of the stress-strain diagram (Fig. 1). This effect influences many of the physical properties of grey cast iron, and besides being responsible for the low ultimate tensile strength of the material, probably accounts for the high fatigue ratio and good damping capacity.

Graphite imparts excellent wear resistance to grey cast iron by providing minute oil reservoirs in the graphite voids left after machining, and any graphite exposed on the wearing surface improves lubrication conditions. The process developed by the British Cast Iron Research Association now makes it possible to cause the graphite to take the nodular instead of the flake form without the heat-treatment necessary in the malleable cast iron process.

It is well known that a given mass of material has the smallest possible surface area when it is in the form of a sphere. While graphite in nodular cast iron is not always in the form of perfect spheres, it is very much more compact than normal flake graphite and under the microscope it therefore appears to be very much less in quantity (Fig. 2). The spherical form of inclusion is the most innocuous from the point of view of introducing local stresses, with the result that the tensile strength, transverse strength and shock resistance are very much improved in cast iron when the graphite is in the nodular form. For example, an iron which would give 8 to 10 tons per sq. in. tensile strength under normal conditions may well give 35 tons per sq. in. when the graphite is nodularised. A small amount of plastic deformation is possible, but ductility is not of the same order as that obtained in malleable cast iron.

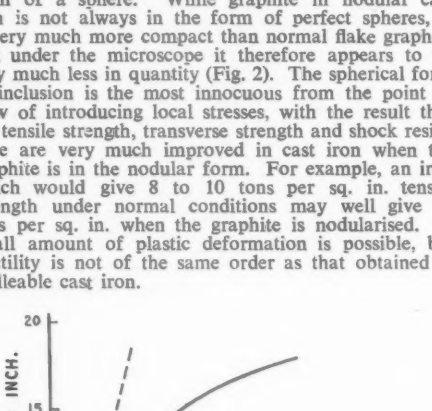

FIG. 1.—TYPICAL STRESS/STRAIN DIAGRAM FOR GREY CAST IRON.

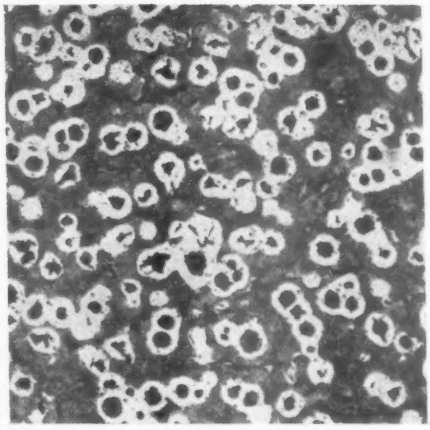

FIG. 2.—NODULAR CAST IRON CONTAINING 3.69 PER CENT. TOTAL CARBON, ETCHED PICRIC ACID. × 60 DIAS.

The absence of normal graphite flakes in nodular cast iron will, most probably, affect the fatigue ratio, damping capacity and wear resistance commonly associated with grey iron. The influence of nodular graphite on these important properties is, it is understood, being investigated by the Research Association at the present time.

The process of producing nodular graphite cast iron or "Nodulite," as it has been called, has been patented by the British Cast Iron Research Association, and technical details covered by the patent cannot be given in this Paper.*

It can be stated, however, that the process is as yet only applicable to high-carbon, low-phosphorus irons, and it is desirable to have the sulphur content as low as possible. Within the limitations at present applying to the process, the material can be produced from cupola-melted iron quite successfully. It is necessary to apply a high degree of technical control to the melting practice in order to ensure success, because of the high carbon and low sulphur content required. The metal must also be sufficiently hot to allow of ladle treatment. Such a degree of furnace control should, however, present no difficulty in a modern foundry. In collaboration with the B.C.I.R.A., a variety of castings have been made in Nodulite from three successful cupola melts at the foundry with which the author is associated. Typical results obtained from the first of these Nodulite melts are shown in Table I on page 343.

The Nodulite process is a very new one and when further investigations and developments have taken place, the engineer will be presented with a new material of exceptional value to him. It should be

*It has now been publicly disclosed that Nodular Cast Irons are innoculated with Metallic Cerium.—EDITOR.

TABLE I.—*Typical Results Obtained from "Nodulite."*

Ladle No.	T.C.	Si.	Trans. rupture stress and deflection, 1.2 in. dia. bar.		Tensile 0.875 in. dia. bar tons per sq. in.	Brinell hardness No.
			Stress, tons per sq. in.	Defl., in.		
11	3.80	2.82	54.2	0.60	30.2	209
16	3.59	2.90	65.0	0.80	34.6	231
22	3.69	2.77	61.4	0.95	34.2	244

regarded as a high-duty cast iron with special qualities, rather than as a new form of malleable cast iron. The latter material has well-known special properties which call for its employment in a wide field which is not likely to be narrowed by the Nodulite process. The malleable-iron processes have themselves been the subject of considerable research work during the war and in post-war years, which will consolidate the important position held by white- and black-heart malleable cast iron in the engineering industry.

The Sodium-carbonate Process

The need for very low sulphur in the molten iron before treatment for the production of Nodulite throws emphasis on desulphurising methods. The sodium-carbonate process is well known and well established. Improved results have been obtained by double-ladle treatment, that is, by tapping on to soda ash in one ladle and transferring both metal and molten alkali to a second ladle, the more intimate mixture thus obtained permitting of a more complete reaction. Ladles lined with basic refractory in the form either of bricks or one of the ramming compounds give very satisfactory resistance to soda-ash attack and assist the reaction. It is possible that an even more active alkali compound may become available for sulphur reduction in the near future.

Valuable work was recently carried out by an Institute of British Foundrymen Sub-Committee (TS 10)[6] on basic-lined cupolas, and one can anticipate that metal melted in this way and subsequently treated in a basic-lined ladle with alkali will give very low sulphur figures, and will be ideal for converting into nodular graphite iron.

Shot-blast Cleaning

The operation of cleaning castings has until recently been a dirty and laborious one. It is not many years since the sand-blast process was banished from the foundry on account of the risk of silicosis to the operator. Shot-blasting was introduced, and many improvements in this method have been made recently. It is now possible to feed castings from the knock-out on to a conveyor which takes the work through a chamber in which shot is impelled on the casting, with the result that the fettler can operate on clean work, with obvious advantages. Another development in the cleaning of castings is the use of high-pressure water jets, and for many classes of work this is an ideal method.[6]

The Sodium-hydride Process

The removal of the last trace of sand from a casting has always been a serious problem to the foundryman. The intricately cored passages in small automobile cylinder blocks and heads must be free to allow of the circulation of cooling water, and elaborate measures are taken to ensure the complete removal of the core sand, even to the extent of pickling in diluted hydrofluoric acid.

Recently a process has been developed in which the castings are immersed in a bath of molten caustic soda in which there is a small concentration of sodium hydride. This bath reacts rapidly with any sand adhering to the castings, completely removing it and leaving the cast surface clean and free from all trace of oxide. Scale and rust are removed as a result of the powerful reducing action of sodium hydride, but there is no attack on the underlying metal. On leaving the molten bath, the work is drained and either quenched in cold water or cooled down in air and then washed in water. When all traces of caustic soda have been removed, the work is left with a silvery metallic surface.

The process should not be used for primary sand removal, but for removing such sand as cannot be got rid of by the normal fettling and shot-blasting operations. For example, the water passages in cylinder blocks, the interiors of manifold castings, etc., which are not readily reached by other methods, may be dealt with with certainty by this new method.

Substitute Materials

The second world war, and indeed present-day conditions, caused, and continue to cause, a succession of grave shortages of raw materials, which the foundryman has had to meet with economies and substitutions hitherto unthought of in the long history of the industry. The Author commenced experiments before the war on the possible use of aromatic residues of the petroleum industry in oil-sand core mixtures. A resumption of this work in 1942 resulted in one-third of the linseed-oil content of the molasses base core oil used in the foundry with which he is connected being replaced by this substitute. Davies and Rees[7] found that considerable economies could be made by using aromatic residues as a partial substitute for linseed oil in a wider variety of oil-sand mixtures. Foundry methods differ widely, and as might be expected this substitute has met with varying success in different works, but there is no doubt that substantial economies in the costly imported linseed oil have been made.

Substitute for imported clays used for synthetically bonded green-sand have been found in this country, and in sterling currency areas, which have sufficiently satisfactory properties to enable British ironfoundries to carry on.

The conversion of eight coke-fired conveyor type core stoves and a sand drying plant to fuel oil burners has been completed at the foundry mentioned above. Some fear was felt that the water vapour produced from the combustion of hydro-carbons might interfere with the core drying process, but this difficulty was not encountered. The cost of oil firing is found to be of the same order as that of coke. Temperature control

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is better than with the hand-stoked coke furnaces, with the result that the cores are of more uniform dry strength and the throughput and yield of serviceable cores has been increased. The fact that the conversion to oil firing, which was so urgently required a year or so ago, is not at the time of writing so helpful to the National economy, is indicative of the kaleidoscopic variety of technical problems with which foundry management has been faced in recent years. These situations have been tackled and will doubtless continue to be countered by one expedient after another.

Plastics

The current work of other branches of scientific and technical development is continually examined by foundrymen, and, where applicable, new materials and processes are adopted.

The plastics industry has made enormous strides in recent years, and some of the products have been found useful employment in the foundry. To mention only a few examples, urea formaldehyde can be used for the preparation of multiple patterns, and has been used successfully as a bond for core sand, as will be described below. Phenolic materials are extensively used for salvaging porous castings, which are impregnated with a solution of the plastic and cured at 150 deg. C. to give a pressure tight sealing. Polyvinyl chloride provides a variety of materials having high resistance to abrasive wear, which are used, for example, for the protection of parts of shot blast plant by using sheets of the material for covering.

Infra-red Heating

The use of radiant heat has been examined by the foundryman, and applications have been found where it can be of valuable assistance in the foundry. There are several satisfactory sources of infra-red rays, such as the electric open type of fire elements or bulbs used in conjunction with reflectors, which incidentally must not tarnish in the foundry atmosphere and are therefore usually plated with rare metal. Another source of radiant heat is provided by a chamber lined was gas-heated panels with dull black corrugated surfaces, thus ensuring a high proportion of the heat energy being radiated into the chamber. The bulb and reflector type of heat radiator have been successfully used for the skin drying of moulds in a light alloy foundry, and the gas method is considered suitable for re-drying cores after blacking, or long storage in cold or humid weather.

Di-electric Loss Heating

During the second world war the development of electronics in connection with radio engineering and radar was rapid and intensive, and this branch of physics has proved to have interesting applications in industry. High frequency current was used long before the war for the melting of metals and for heat-treating ferrous materials. The war saw rapid progress in the use of higher frequencies for heating di-electrics in such applications as wood glueing, plastic heating, etc. When a difference of electrical potential is applied to a non-conductor, little or nothing happens if the electrical supply frequency is of the order of only 50 cycles per second, but if the frequency is increased to the order of 2 to 15 megacycles per second the molecules of the non-conductor become excited and heat is generated. A feature of this method of heating is that the heat is generated throughout the mass and does not need to be transferred from the surfaces to the centre by conduction.

The equipment consists of an electrical set for converting normal alternating current supply to the required high frequency. From the set, the supply is usually taken to two parallel conducting plates, known as electrodes. The object to be heated is placed between the electrodes, which can be either horizontal or

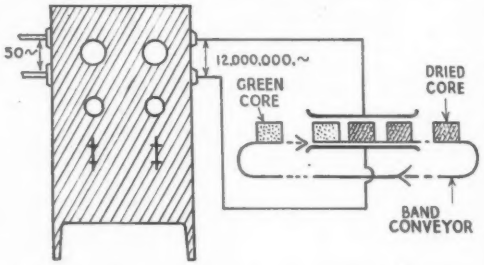

FIG. 3.—DIAGRAMMATIC ARRANGEMENT OF CORE-DRYING BY THE DIELECTRIC LOSS METHOD.

vertical, and the electrodes can either be in contact with the object or separated from it by an air gap. Electrically, it is usually possible to earth one of the electrodes, but in some cases it is preferable to have none earthed. The gap between the electrodes can usually be adjusted and a band conveyor be arranged to pass the work between the plates at the required speed. With horizontal electrodes, with the lower one earthed, a steel band or wire mesh belt can be used, but with vertical electrodes the belt must be made of non-conducting material. A diagrammatic representation of the apparatus is given in Fig. 3.

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[3] A. L. Norbury and E. Morgan, J.I.S.I., 1936, No. 11, pp. 327-346.
[4] H. Morrogh and W. J. Williams, J.I.S.I., Vol. 155, Pt. III, pp. 321-371.
[5] I.B.F. Sub-Committee (T.S.10) Report, FOUNDRY TRADE JOURNAL 1947, Vol. 81, April 3, pp. 259-267.
[6] F. N. Lloyd, I.B.F. Proc. 1944/5, Paper No. 820, pp. 23-44.
W. Davies and W. J. Rees, J.I.S.I., 1944, No. 11, pp. 49-68.

(To be concluded)

The Specification and Testing of Cast Iron

*London Branch Discussion of the Paper presented by Dr. A. B. Everest**

After the presentation of the Paper to the London Branch of the Institute of British Foundrymen, the chairman (MR. P. D. PINCOTT) said Dr. Everest had presented a remarkable and detailed survey of the development of cast iron and the almost parallel development of specifications. The year 1928, he continued, did not seem to be a very long time ago; yet it was in that year that the Specification No. 321 came into being, calling for tensile strengths in grey cast irons of 9 tons per sq. in. for grade C and 11 tons for Grade A. But even at that time founders were not quite sure that they could achieve such tensile strengths in their products, because tensile tests in those days were very few and far between. The earlier tests on cast iron were related to a transverse test, using a bar in the nature of 1-in. square, at about 12-in. centres. From that time onwards, however, cast iron had really begun to develop, and to-day it definitely was a tough and strong material. The specification system could be regarded as a tribute to the ironfounders, indicating as it did that they could move with the times.

Should Composition be Specified?

MR. A. J. NICOL SMITH, commenting on Dr. Everest's remarks as to the necessity or otherwise for specifying composition, he said he had always favoured the established foundry attitude that the foundryman should be told what was wanted and should be left to make it in his own way. There were snags, however. For example, if users just called for an iron of 25 tons per sq. in. tensile, they were liable, as Dr. Everest had shown in discussing the effect of phosphorus, to get a material having the wrong sort of impact figure. The answer might be in the future to specify the impact test; but the impact specification was comparatively new and the figures applicable to various grades and various uses were neither fully understood nor well known. So that it was comprehensible that users were worried about phosphorus content. In the specifications they had got away with that to the extent that they could call for a limit of phosphorus content; but more difficulties of this sort might have to be tackled in the future.

The steel maker had to put up with the specification of composition as well as properties. There were reasons for that, one being that it was not easy for a designer just to state properties which were sufficient and all-embracing. When the material had to be heat-treated at other than the manufacturer's works, somebody must know something about the composition. It was the established practice in the steel world that the people concerned with heat-treatment must know the composition; and the same thing could arise in connection with the mass production of heat-treated iron castings. If the foundryman produced castings which had to be treated by somebody else, then he might have the composition tied up for him. He might, in fact, have to compromise more than he had done in the past on this question of composition control in specifications.

DR. EVEREST, who expressed agreement with Mr. Nicol Smith, said the object of his diagrams was to emphasise that one could not cover adequately the properties of cast iron by any one test, such as the tensile test. His own view was that in future one might be able to meet the requirements by reference to, say, tensile and impact; those were the two that he would support, once the industry could get the impact test thoroughly established. That, of course, would take care of the phosphorus problem. Yet, as cast irons became more complex, one might have to go back to composition; that might have to be reconsidered particularly when the heat-treatment question was put forward.

Correlation With Design

MR. R. B. TEMPLETON (President-Elect of the Institute), who agreed with all that Dr. Everest had said, commented on the transverse test which in his view should have been abandoned long ago. It assumed, he said, that the tests followed Hooke's law which laid down that the applied stress was proportional to the strain within the elastic limit, but as the neutral axis of the transverse bar deformed under load, the stress was not proportional to the strain. Why foundrymen should still continue to use transverse tests, or to give figures of deflection based on transverse tests, he could not imagine, because they were of little use to the engineer. The transverse test was a foundry control test, and not a test upon which an engineer could base any design values. The engineer wanted fundamental values of the materials he was using and he could not be involved in speculation. If foundrymen wished to sell their castings, with a guarantee, they must be able to give the engineer figures on which he could design.

Work on all tests other than the transverse should be continued, and Mr. Templeton would like to see the Technical Council of the Institute develop Modulus of Elasticity and Modulus of Rigidity tests for cast iron. Foundrymen would then be able to give the engineers fundamental data, and break down their idea that cast iron was an unreliable material.

DR. EVEREST, again expressing agreement, emphasised that the preparation of a specification was a two-party undertaking the specification being in the nature of a contract between the manufacturer and user. The Technical Council would like to see the transverse test abandoned, as would also, he believed, the British Cast Iron Research Association, but it had lasted from the earliest days of specifications, and they had not yet succeeded in eliminating it or whittling it down. The earliest specifications, he believed, were issued by the

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*Paper printed in the JOURNAL, April 1, 1948.

Specification and Testing of Cast Iron

Admiralty and were based on a transverse test. Indeed, it was surprising how far back in time it extended; people such as Tredgold, about 1840-50, seemed to know a lot about cast iron, based on the transverse test, when cast iron was used extensively for bridge building, and so on. In this connection, Dr. Everest said he had recently read a book in which it was stated that when the House of Commons was blitzed 150 tons of cast iron had been collected from the wreckage in the form of cast-iron girders, columns and beams. That was something worth thinking about.

Autographic Tests

MR. A. R. PARKES mentioned the autographic test on cast iron, whereby a written record was obtained of the test. It was developed particularly for the testing of cast iron piston-ring castings. In particular, the machine drew the load/extension curve for the material under test automatically while the test was proceeding. and thus produced incontrovertible proof, in the written form, of the success or failure of the test. There were developments from that; one could thus determine the elasticity of the material, and its permanent set.

In the case of the cast iron to the 4K6 specification for piston ring pots, one obtained autographically almost a straight line during the early part of the test, and then a gradual curve away as the material took more permanent set. On the other hand. for the Ni-resist type of material there was produced a curve from the very beginning of the load/extension diagram. Yet an interesting feature of the Ni-resist material was its toughness. In that connection he recalled that the late Mr. G. Williams had developed a test for the measurement of the toughness of cast iron on the autographic machine. The toughness was related to the work done in breaking the test bar, as represented by the area underneath the curve of the load/extension diagram. The "toughness index," which was calculated from that area, was very useful in comparing one grade of cast iron with another and particularly when testing Ni-resist; it was used there as the foundry control test for that material.

At one time, in the foundry with which he was associated, they had had to work to Specification D.T.D. 233 for aircraft piston ring material. It was found to be almost unworkable, the material had to contain 1.8 to 2.4 per cent. silicon, a minimum of about 0.35 per cent. chromium and about 0.60 per cent. molybdenum. These were conflicting figures, bearing in mind that it was required to produce a cast iron having no free carbide at all when made in a cast-iron mould. It had to be completely pearlitic; the maximum combined carbon being about 0.9 per cent. Strangely, they had at last produced a suitable cast iron; but they had seldom met the D.T.D. 233 specification, which he believed had now been modified.

Asking Dr. Everest's opinion of ring tests in general and their relation to present specifications, he said the ring test was a combination of the transverse and the tensile, and it had to be used in connection with the manufacture of centrifugal castings because of the difficulties associated with the machining of test-bars from pipes.

DR. EVEREST replied that the ring test had a great deal of interest; it was considered by a Committee of the Institute, and the relationship between ring tests and ordinary tests was at the moment under consideration by the Research Association. There was no doubt the ring test showed factors which were not easily determined otherwise, particularly the toughness index; but it was too soon yet to express a definite opinion. Of course the ring test was really a test on a finished component. Many specifications included tests on finished components, most of them being destructive, such as the drop tests; there were also pressure tests on finished components.

MR. W. W. BRAIDWOOD commented on the difficulty of producing, by vertical casting methods, long narrow test-bars. Often there was porosity, which took the form of a narrow pipe. He had always found horizontal pouring of such castings to give thoroughly sound bars. Expressing agreement with Dr. Everest concerning the importance of the impact test, he asked why the Committee which had framed the British Standard Specification had used British units for every other dimension yet had specified a striking height of 22 millimetres!

In addition to considerations of phosphorus content, an important factor affecting impact was the arrangement of the graphite. He had used the modified Izod test long before it was accepted in a British specification and had demonstrated that it was quite possible to produce a high-strength cast iron without inoculation with tensile strength well in excess of 20 tons, but with an impact value of only 10 or 11 ft.-lb. Though tensile strength was only slightly increased by effective inoculation, impact value could readily be doubled.

DR. EVEREST said it was hoped that, as a result of future Committee work, a shorter bar might be specified; Sub-Committee T.S.4 had issued recommended methods for casting bars and unanimously advocated casting on end. He stood by that recommendation but agreed with some people in industry, and the Research Association, who advocated the shorter bar. The present transverse bar was too long in relation to its diameter, and a shorter bar might be the answer to the soundness problem.

As to the specification of the striking height in the impact test in millimetres, he said Mr. Izod was a native of his own home town and certainly had nothing French about him. He could give no reason for the selection of the 22 mm. striking height, but this was now a world standard. Experience with the impact test showed up the advantages of having two tests, and he would still like to see tensile plus impact quoted as a kind of quality index of castings.

Vote of Thanks

MR. J. F. CHAMBERS, proposing the thanks of the Branch to Dr. Everest for his Paper, said one was impressed by the tremendous amount of work done by the Technical Sub-Committee and the very large share which Dr. Everest personally had taken in that work.

(*Concluded on page* 350, *col.* 2.)

Salvage of Cast Iron by Heat-Treatment*

Treatment produces favourable dimensional, strength and hardness changes

By Davidlee V. Ludwig

One of the defects most frowned upon in cast iron in the past has been its tendency to grow when subjected to wide changes in temperature. This lack of dimensional stability has earned for it a bad name but, in point of fact, the error has lain in the judgment of those who chose cast iron for applications wherein it would be subjected to temperatures at or near its range of critical transformation, such as exist in furnace grates, heat-treating conveyor parts and the like. The selection of cast iron for such applications has generally been guided by the erroneous concept of initial low cost, rather than inherent ability of the material to perform satisfactorily.

Within temperature ranges of conditions normally outside of melting and processing furnaces and other high temperature units, cast-iron alloys have exceptionally stable dimensional characteristics when properly prepared and machined. The very defect which has militated against its misuse may be converted into a most effective ally in the control of production losses through machining practices. In the fabrication of parts such as crank or camshafts, it is inevitable that precision dimensions will be lost through under-machining of a given section, with the result that an otherwise useful part, in which much time is invested, will be scrapped. The ability of cast iron to grow offers a ready means of reduction of such losses.

Ballistic Cams

The Sperry Gyroscope Company was using a high grade of cast iron as the material in the ballistic cams of detector mechanisms. There were three types of cam units involved, weighing from 15 to 55 lb. each, as cast. The most complex unit consisted of three three-dimensional unit cams cast on a single axis. The function of the triple cam was to cross-co-ordinate three data computations relating to the position of an aircraft in flight, converting the mechanically deduced positioning data into electrical impulses needed to guide searchlight and gun battery equipment.

The defective nature of the iron being used was brought to the management's attention by the unexpected rejection of six completed triple ballistic cams by the Government inspectors. The loss of £1,000 represented by the six units was at that time nothing to the implied loss which might be discovered if an appreciable percentage of the castings on hand, in stock and process were to be of comparable structure.

*Abstracted from an article appearing in the American magazine, "Materials and Methods."

Specification Details

The nominal composition of the cast iron had not been too closely controlled up to that date. The final modified specification that was evolved by the materials engineering staff, following discovery of the defective material, was as follows:—

Desired Chemical Composition, Per cent.

Total carbon	3.05 to 3.30
Combined carbon	0.60 to 0.75
Graphitic carbon	2.45 to 2.65
Silicon	1.80 to 2.10
Manganese	0.60 to 0.80
Nickel	0.50 min.
Phosphorous	0.20 max.
Sulphur	0.10 max.

Required Physical Properties (cast bars 1¼ in. dia.)

Ultimate tensile strength	23.2 tons per sq. in.
Transverse fracture	3,000 lb. actual min.
Deflection	0.30 in. min.
Brinell hardness number	196 to 220

The above specification details were evolved in an effort to secure a grade of controlled iron from the source which would ensure the characteristics essential

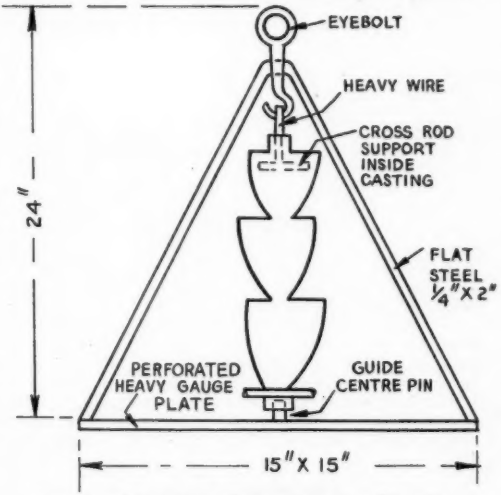


FIG. 1.—GYROSCOPE CAM HELD IN A JIG FOR HEAT-TREATMENT.

Salvage by Heat-Treatment

to the performance of the cams. The only points of true significance to the functional purpose were the hardness, which governed both the ease with which the precise dimensions could be attained as well as the ability of the material to stand up under load, and the size and distribution of the graphite, which determined how true to the normal contour the work surface would be.

The actual physical properties listed above, in conjunction with the high-carbon iron specified, probably could not easily be ensured, in the range of Brinell hardness desired. In practice, these combined properties were not obtained, nor were rejections based on failure to conform to all limits, but rather on actual structural details affecting the machinability, wear resistance and freedom from serious pitting. If this sounds contradictory, it is because circumstances with regard to supply, and particularly with respect to production consignment requirements, prohibited any other policy at the time, though ultimately, due to the lack of sources of supply of sufficiently high quality iron, a substitute material was developed to replace the iron.

Material Achieved

The actual range of quality of the material received until the time of the rejection of finished parts was as follows (based on rapid checking of stock samples):—

Actual Chemical Composition Range, Per cent.

Total carbon	2.20 to 3.50
Combined carbon	0.40 to 0.85
Graphitic carbon	1.80 to 2.75
Silicon	1.50 to 3.20
Manganese	0.40 to 1.00
Nickel	0.25 to 1.30
Phosphorous	0.15 to 0.40
Sulphur	0.005 to 0.15

Actual Physical Properties

Ultimate tensile strength	13.4 to 23.2 tons per sq. in.
Transverse	1,800 to 3,800 lb.
Deflection	0.14 to 0.38 in.
Brinell hardness number	140 to 240

The test specimens supplied had been duplicate transverse bars of the standard type, 18 in. by 1¼ in. dia. Tests were made with standard equipment; Brinell hardness numbers were determined both by means of 3,000 kg. Osen Brinell impressions and from converted Rockwell B hardness tests.

Following rejection of the six completed cams, a complete survey of the condition of every cam in stock and production was made. The project disclosed the presence of over 700 units, in various stages of production, which were too soft to be usable. Hardness was used as the determining test, for it was most representative of the performance defect, which was the basis of the initial rejection.

A Reclamation Problem

Loss of the 700 units meant loss of approximately six months of cam production time, a cash loss of perhaps £100,000, and a consignment loss of hundreds of completed units. Therefore, the management wished to ascertain what, if anything, could be done to save the group. Permission was granted to experiment with 24 of the otherwise scrapped cams. Believing that the material would grow when heated and quenched, the only questions to be answered were:—(1) The correct heat-treatment for processing the lots, and (2) the type of fixtures necessary to prevent distortion of the triple cams.

After experimentation with round specimens 1 in. tall cut from five representative arbitration bars, 15 pieces from each bar, it was determined that a heat-treatment procedure could handle all of the various compositions represented by the wide range of different castings, in the following manner:—

Five sample heat-treatments were performed, each batch containing three samples from each of the five bars. The purpose of the treatments was to determine which combination of transformation temperature, quench media and tempering methods would result in the desired hardness and optimum growth. It was discovered that all compositions responded suitably to oil quenching from 900 to 925 deg. C., in so far as growth and initial hardening were concerned. However, the fact that the varying compositions produced hardness ranges from 350 to 550 B.H.N. in the as-quenched specimens precluded a single tempering time and temperature. The most difficult phase of the experiments was the determination of proper procedures for tempering the irons back to the range of 196 to 220 B.H.N.

Ultimate Procedure

The final production procedure involved heat-treatment of all defective cams for 1 hr. at temperature in a controlled atmosphere furnace at 900 to 925 deg. C., quenching in hot oil, then cooling slowly to room temperature. When cool enough to handle, Brinell hardness numbers were determined, by means of portable impact hardness testers, and the quenched cams were divided into groups, according to their quenched hardness, from 350 to 550 in steps of 50 B.H.N. and were then tempered by holding them for 30 min. at temperature ranging from 590 to 700 deg. C. The hardest as-quenched castings were tempered for 30 min. at 700 deg. C., and each successively softer group tempered at successively lower temperatures in steps of 25 deg. C. By this means, all 700 units were brought without exception into the desired range of hardness.

To prevent distortion of the triple cams, which were 18 in. long and varied from a cored journal diameter of 1½ in. to a maximum cam divergence from centre line of approximately 3-in., jigs were built to suspend the cams from one journal in a vertical position, as shown in Fig. 1. The lower journal end-bearing barely touched the bedplate when the cam was placed in the furnace. This suspension tended to intensify the tendency for lateral growth, and actual growth in excess of 0.01 in. was frequently found, but in view of the fact that the overall length of the partially finished cam was not important, and the fact that the journals were re-

moved in the final production stages, this increase in length was not of major consequence. The triple cams were removed from the furnaces with special hook cranes which lifted by a large ring welded to the top of the jig; jig and casting were quenched together. In spite of the fact that many journals had been ground to parallelism and concentricity to dimensions of 0.0001 in., no cam was lost through distortion.

Scaling Reduction

The atmosphere in the furnace originally was produced merely by setting the burners for reducing flames on a direct oil-fired furnace. This method was partially satisfactory, the reducing flames preventing scaling beyond a measured 0.003 in. However, the extent of the scaling of the finished journals endangered some of them which attained a growth of only 0.005 in. on the 1½-in. journals. Therefore, fully controlled furnace atmosphere treatments were used for all but the first few castings, the parts being processed in electrically heated pit furnaces supplied with generated controlled atmospheres.

In spite of the close finish required on the locating journals, the growth of material, which varied from 0.005 to 0.015 in., was adequate to permit regrinding of all controlled dimensions on the salvaged cams. Furthermore, production reports showed a marked improvement in machinability of the castings, even over those which were initially satisfactory, and final polishing reports were good. The men who polished the final data surfaces reported a greater freedom from grittiness, or tendency to develop scratches in final polishing.

The method of producing these ballistic cams and the methods of heat-treating them for salvage, is directly applicable to cast-iron engine cam- and crank-shafts. Vertical suspension of such parts is necessary to avoid sagging during processing, but apart from the necessity for having jigs and fixtures for the suspension of the various types of cams and shafts in production, no other special equipment is required. Each alloy composition will have a different response to heat-treatment with respect to total growth, quenched hardness and tempering treatments, but the particular method of handling required may readily be determined and standards established for the salvaging of production scrap.

Widening Field for Cast Iron

Following the successful recovery of the 700 units, the Sperry concern detailed standard procedure covering the method, which was used for the same purposes by various other manufacturers licensed by Sperry in the States and in England, so that it was not necessary to lose any cams by reason of improper hardness or low physical properties. Furthermore, once the growth characteristics were known, the cam department used them as a means of recovering stock on cams where surfaces had been ground under tolerances. This was a most important salvage tool, due to the extremely close tolerances which were held on the final data surfaces of the complex cams.

Therefore, it was developed that the most outstanding deficiency of cast iron for engineering applications—its tendency to permanently increase in volume when heated above its critical transformation range—became an unusual ally in production of precision parts from alloy iron. Full use of the salvage potential of cast iron, through proper heat-treatment, should enhance its value as a production metal through the overall reduction of the unit cost of finished items. The economic significance becomes increasingly important as the complexity of the part increases and the total time spent in attaining finish dimensions grows.

Death of Mr. F. J. Cook

It is with regret that we record the death last Monday of Mr. F. J. Cook, M.I.Mech.E., a founder and past-president of the Institute of British Foundrymen.; Mr. Cook was born in a house attached to a foundry and the moulding floor was his playground. He was a patternmaker by trade and for many years was foundry manager to Belliss & Morcom, Limited, Birmingham. It was whilst he was holding this position that in 1904 he helped to found the Institute. He was unable to be present at the first meeting, but sent a representative, Mr. Vickers. He became the third president in 1908, and presided with great distinction over a Conference held that year in Birmingham. He organised visits to the new University and to the works he superintended. There was no banquet, but a smoking concert was held. Mr. Cook throughout his long life managed to keep abreast of both mechanical and metallurgical developments within the industry. His achievements were recognised by the award of the Oliver Stubbs Medal and by honorary membership of the Institute in 1932. He was for a period on the directorate of Rudge Littley, of Swan Village, West Bromwich. After relinquishing this position, he became associated with the British Cast Iron Research Association in a consulting capacity. He was one of the pioneers of mechanisation. Amongst the foundries which used his services in this connection were Cardiff Foundry Company; R. A. Lister & Company, Limited; Parkinson Stove Company, Limited; Broom & Wade, Limited, of High Wycombe; Aiton & Company, Limited, of Derby, and Davey Paxman, of Colchester. The majority of this work was done at a time when most people would be thinking of retirement. "Britain's best known foundryman" is an appellation well applicable to Mr. Cook, yet he would probably prefer to be remembered as the "Peter Pan" of the industry, because he had a genius throughout his long life of making friends with the youngsters of each generation, whilst retaining the admiration and interest of the more mature. The loss of this outstanding pioneer of the foundry industry at the age of 78 years will be long felt and sincerely mourned.

MR. P. C. BOOTH has been promoted to the Board of Directors of Booth & Brookes, Limited, of Burnham-on-Crouch, Essex.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

INDUCTION-HEATED CUPOLA

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—We have read with interest an article appearing in the FOUNDRY TRADE JOURNAL on March 11, 1948, entitled "The Induction-Heated Cupola." This article, it appears, is reproduced from "The Iron Age" and describes a melting unit proposed by Dr. E. Piwowarsky, of Germany, wherein are combined the advantages of the cupola with the advantages of the electric induction furnace.

We would like to point out that a number of years' research and experimental work of a similar nature which has been carried out by this company in Smethwick ultimately resulted in our application for a patent early in 1945 and the publication of the Specification in August, 1947, of our Patent No. 591117.

The metallurgical reasoning of Dr. Piwowarsky and the advantages claimed are practically identical with those discussed in our Patent Specification, and we are very interested to find that similar ideas have been developed in another country.

We suggest, therefore, that it would be only fair to the British foundry industry to let it be known that the thoughts expressed in this article are not new, and that the work is so far developed by this company that full scale cupolas have been equipped with subsidiary electric heating means and have been worked on a practical scale for some time.

Yours, etc.,
The Midland Motor Cylinder Company, Limited,
G. F. YORKE,
March 24, 1948. Joint Managing Director.

A VENT THAT WAS MISSED

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I always read the practical, interesting articles from your occasional contributors, and, like other foundrymen, often compare notes on the details as set out. So, with Mr. Gudgeon's brief article on the gas burner, I venture to add a few further tips which may apply to other similar problems.

There are simple alternatives to the expensive wax wire vents advised for use "round the bend," in the 26-in. by 2-in. dia. gas burner, described as blowing or heaving in the riser; the $\frac{1}{4}$-in. dia. rod vent seems small for the quick running of $\frac{3}{16}$-in. stream of metal. Carrying a larger vent rod out through the "bend end" and plugging the hole after the core is turned out ensures no shortening of the vent length.

Where cores of this type are made in one piece, carriers (or packers) have to be used. It is sometimes more economical to make "flat back halves" and then file a groove in the dried halves before sticking them together.

The old-fashioned thick string has much to recommend it for "round the bend"; a piece secured in the end of a $\frac{5}{16}$-in-tube would provide a continuous vent, laid in position in one half-core box, during the "one-

(*Concluded at foot of col.* 2.)

piece" core making.

In many cases a few seconds taken off the running speed (by reducing the ingates) will materially reduce the rate of gas expansion in the core.

Yours, etc.,
J. T.

The Specification and Testing of Cast Iron

(*Concluded from page* 346.)

He felt the Committee had done the right thing in keeping the main specification as simple as possible and avoiding the specification of tests additional to the main tensile test. But with regard to cases where specific properties were required in materials for particular purposes, special tests might be indicated as applicable. Without saddling the Committee with more work, it would perhaps be helpful to put forward, not standard specifications, but recommended procedures—as, for instance, the recommended method of casting a test-bar—to cover such additional matters as stress-relief treatment. In that connection he recalled Mr. Templeton's reference to moduli E and G, and said a recommended method of procedure to measure these properties would be helpful.

Commenting on the point made by Dr. Everest that the new specification would be almost out-of-date by the time it was published, he wondered whether it would not be possible to legislate for the future by setting a standard which, though it might not be achieved now, would constitute a target at which producers could aim. There was the danger that it might be a temptation to specify the target before the industry was ready for it, but on the other hand it might be advantageous.

MR. G. R. WEBSTER (Past Branch-President), seconding the vote of thanks, made the point that items raised in the Committees of the British Standards Institution were not submitted to vote; thus, neither manufacturers nor users could get away with anything by a snap decision; the decisions made must be unanimous and were democratic. That fact was important and probably helpful to manufacturers. It was a very great pleasure, he concluded, to second the vote of thanks to Dr. Everest for a most interesting Paper, presented in a very genial way.

The vote of thanks was accorded with acclamation.

DR. EVEREST, in his response, expressed appreciation of the manner in which his Paper had been received, and said he had enjoyed presenting it. He was interested in Mr. Chambers' reference to putting forward recommended procedures on matters such as heat-treatment, and said he had made a note of it and would raise the matter in the proper quarter.

With regard to the possibility of legislating for the future by setting a standard which might not be achieved yet, and the reference to the danger of such a standard being called for too early, he emphasised that the figures in the specification were minimum figures, and the practical man had generally to aim at achieving at least 2 tons tensile higher than the minima, to allow for the ordinary variations in the foundry. He felt it would be necessary to wait for a year or two before making the next jump.

Stress-Relief Treatment of Iron Castings

Discussion in Manchester

(*Concluded from page* 328.)

Three Categories of Treatment

MR. A. JACKSON (Accrington) thought the Paper was more suitable for the engineer than the foundryman. The casting was cooled first, and then the stress in the casting was treated in order to obtain a better homogeneous whole. The discussion would appear to centre around three subjects:—(1) The foundryman's job inside the foundry; (2) stress relief as it appealed to the engineer; and (3) the annealing of castings for special purposes, such as machining, etc.

With regard to the first point there was a certain amount of information obtainable from the textbooks. He remembered that when he went into a new shop one of the first castings given to him was about 4 ft. or 5 ft. long, 9 in. wide, and ¼ in. thick, and of a wide pattern. Of course, there was a question of contraction and expansion and stress relief. What he actually did was, first of all, at about 6 in. from the end of the pattern, he bedded-in two iron bars and made them absolutely straight. There was evidently no way of bending a wide pattern of that thickness. Then he made the sand bed and put the pattern on it. There was then the question of running, and it had to be run cleanly. The next thing was to tackle the stress relief after the casting was finished, because it would buckle after the top was taken off. So the plan was to bare the centre portion of both sides simultaneously, so that the top and the bottom of the casting would cool equably in that central area. The casting turned out all right. Another job in the same shop was the making of lathe beds, 5 or 6 tons in weight. The question of stress relief was entirely different. For cambering these castings, to bring about the straightness required, a suitable bend was put on the lower face of the sand moulds.

The aim of the scientist should be to enable these particular points to be brought within the understanding of the average practical man. Such a man would be all the better for some knowledge as to why and how particular results occurred. With contraction it was better to try to ascertain the exact position at which a bent casting required attention in order to get it straight, especially if it was a sizeable job. This was not easy; there were, of course, various ways in which thin sections, especially, could be hammer peened effectively to extend certain parts. Another point in which foundrymen were interested, and which necessitated careful treatment, was the prizing up of a casting while it was cooling-off in order to have it straight when cooled. This really meant that before a casting actually cooled a question arose, in a way, of how to help the casting, without damaging it, to contract in a normal manner. Yet another further point was, were stresses set up in castings when they were annealed at about 750 deg. C. for machining purposes?

Causes of Stress

MR. BENSON replied that annealing at a temperature of 750, 800 or 850 deg. C. would effectively relieve any stresses in the casting beforehand. Provided that the casting were properly cooled, it should not come to any harm. If the annealing was followed by relatively rapid cooling then, having regard to the size and shape of the casting, a new set of stresses might be introduced. He imagined that there would probably be cooling in the furnace after the treatment, in which case the method would be perfectly safe. This, however, tied up with another question—where did the internal stresses develop?

Mr. Benson then illustrated his point by means of a diagrammatic sketch upon the blackboard.

MR. E. LONGDEN thought that there was one aspect which had been missed, namely, the phase changes and transformation points during the cooling-down period of the metal. He declined to accept the opinions of several speakers that growth did not play the most important part in relieving stresses at the stated temperatures. There was a definite growth in cast iron at the elevated temperatures employed. There was growth in cast iron even when it was subjected to superheated steam temperatures, although oxidation plus an increase in graphite might be contributory. Under such conditions, there would be an easement of the metal structure and an accommodating re-orientation of the crystals of the metal.

MR. D. FLEMING (Bury) said he would like to remove a possible misunderstanding. When he had stated that probably few people would have interest in stress-relief, or that it was not a sort of universally interesting subject which every foundryman would turn to, he was being very specific. He was referring only to relieving the casting after the stress had occurred. His contribution to the discussion was based on the fact that the *causes* for the stress in the first place were an extremely interesting subject to all foundrymen.

MR. A. BOYES (Warrington) thought the Report was of very great value, but, as Mr. Fleming had said, it did not help foundrymen as far as the casting on the the floor was concerned. As regards the first slide illustration, he thought he was right in saying that the cracking was overcome, in the first place, by a slight modification in the design, and, in the second place, because the design of the core boxes was altered. The core was split up into two or three cores, where previously there had only been one. Thirdly, an attempt had been made to cool the casting down according to a controlled cycle, and, after all that had been done, the casting was annealed or stress relieved. What he would like to know was, could the casting be stress relieved safely without the burden of easing it in the mould? In view of the Garratt Report on the conditions in iron-foundries, he was sure he was voicing the opinions of many people in stating they were much disturbed by the remarks with regard to the easing of iron castings. Was stress relieving going to assist foundrymen by doing away with a lot of easing during cooling down in the mould? In the case of the casting shown on the screen, he thought the stress-relief treatment did not do away with the easing. Easing might solve the problem, and

Stress-Relief Treatment

not be a very difficult task with small castings, but it would be a very difficult one for those weighing 20 tons or thereabouts.

The Sub-Committee T.S.17 were to be congratulated upon having produced a very fine Report, and the Branch had been very fortunate in having Mr. Benson to comment upon it.

Suggestion for a New Committee

MR. BENSON explained that the Report was one upon stress relief and not upon how to avoid stresses. What was now required was the appointment of a committee to ascertain how to avoid them, which was much more important than knowing how to get rid of them. The foundry of the future would have to produce castings which had no stresses, and to do this it might be necessary to have annealing coils in the cores or to surround a particular part which would cool quickly. There might have to be exothermic reactions to keep warm parts which tended to cool first. There was one difficulty, however, namely, that it was not possible to tell by any simple test whether any casting had a stress in it or not. As long as it did not crack it was impossible to tell whether it would actually crack or otherwise deform in subsequent use. There had been many statements published about X-ray testing for the measurement of internal stresses. It was quite correct that the method worked so long as it was applied to a beautifully machined piece, and where the machined surface was relieved by etching or other means. It was then possible to ascertain the stress inside, but in ordinary general ironfounding the method was not practicable.

MR. E. LONGDEN was interested in a report that in America there was a process for stress-relieving by mechanical means by suspending the casting and vibrating it.

MR. R. YEOMANS (Salford) thought the logical course to take with large awkward castings was to modify the design. Foundrymen would eventually have to make use of annealing furnaces or stress-relief furnaces.

MR. A. BOYES (Warrington) pointed out that a designer could only alter the design within certain limits.

The SENIOR VICE PRESIDENT (Mr. H. Haynes, Ashton-under-Lyne) mentioned the incident when, during the moulders' strike in 1926, a casting could not be dug out of the floor and was left in for 18 weeks. That casting was a better one through not being touched than it would have been if it had been bared in the mould.

MR. C. R. VAN DER BEN (Ashton-under-Lyne) said there was one process which went a considerable way towards relieving the position, namely, the Perlit hot-mould process.

MR. E. LONGDEN (Manchester) said it was an old foundry dodge, with respect to a casting which tended to crack, to heat up the mould before pouring it.

MR. L. A. TOPHAM (Rochdale) said that in heating iron to a low temperature, when it came to the plastic stage the crystals seemed to become elongated in the direction of stress, thus relieving the stress in the casting.

MR. G. A. SOUTHERN said that mechanical vibration tended to relieve stress.

MR. E. LONGDEN (Manchester) was of opinion that there was more than one way of relieving stress, but in that discussion it was heat treatment which was being dealt with and not mechanical treatment.

MR. C. R. VAN DER BEN (Ashton-under-Lyne) said that with a casting in a state of internal stress, if the stress was being continuously applied, it was to be expected that in time the ordinary phenomenon of creep would automatically relieve it.

MR. G. WHYATT (Sale), referring to low-temperature stress relieving, said he was at one time having considerable trouble with castings and "creep" in them. He was one of the few people who had conducted experiments. Cast iron stress-relieving at 500 deg. C. obviated creep in the casting. Then going to 600 deg. C., 700 deg. C. or 800 deg. C., stresses appeared again after machining and the creep was still there. After making quite a number of experiments he came to the conclusion that within 450 deg. C. to 500 deg. C. was the best range for stress-relieving in cast iron. Of course there were other temperatures for other materials.

MR. W. COLLINGE (Bolton) said that three years ago he had occasion to make internal gears which cracked. It was found that casting at a very high temperature did eliminate the trouble somewhat, but was not 100 per cent. successful; so they actually changed to a rotary furnace and superheated the metal, and found there was no need for stress-relief at all. He cut one of the gears into two, and in the boss, due to low-temperature casting, there was found a defect in the centre. Another one cast with super-heated metal was found to be absolutely solid; he presumed this was due to the slower rate of solidification.

The SENIOR VICE-PRESIDENT (Mr. H. Haynes, Ashton-under-Lyne) had had a similar experience. Casting temperature was very important for the success of a casting.

Forthcoming Events

APRIL 12.

Institute of British Foundrymen .

Sheffield Branch:—Annual General Meeting, followed by "The Choice of Metals for Use as Castings," by E. Wilson, at the Royal Victoria Hotel, Sheffield, at 7.30 p.m.

APRIL 13.

Sheffield Society of Engineers and Metallurgists.

"Thin Films on Metals," by Dr. Ulick R. Evans, M.A. Joint Meeting with the Sheffield Metallurgical Association, at the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

APRIL 16.

Institution of Chemical Engineers.

Annual Corporate Meeting and Luncheon, at the Connaught Rooms, Great Queen Street, London, W.C.2, commencing at 11.45 a.m.

Increases of Capital

Details of increased capital have been announced by the following companies:—

Vanda Meters, Limited, Brierfield, Lancs, increased by £11,000, in £1 ordinary shares, beyond the registered capital of £1,000.

William Robertson, Limited, ironmasters, etc., of Warrington, increased by £40,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Penney & Porter (1932), Limited, general engineers, etc., of Lincoln, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £10,000.

H. B. Clarke Engineering Company, Limited, Old Broad Street, London, E.C.2, increased by £4,100, in £1 ordinary shares, beyond the registered capital of £1,000.

Airmec International Sales, Limited, engineers' merchants, etc., of Perivale, Middx, increased by £40,000, in 160,000 5s. shares, beyond the registered capital of £10,000.

Taylor & Osborne, Limited, manufacturers of ferrous and non-ferrous metals, etc., of Birmingham, increased by £2,000, in £1 shares, beyond the registered capital of £2,000.

Fletcher, Houston & Company, Limited, ironfounders, of Birmingham, increased by £20,000, in 400,000 ordinary shares of 1s. each, beyond the registered capital of £10,000.

Edwardes of Langport, Limited, agricultural machinery manufacturers, etc., of Langport, Som, increased by £4,500, in £1 ordinary shares, beyond the registered capital of £500.

Cranford Prince & Johnson, Limited, agricultural engineers, etc., of New Queniborough, Leics, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

Stove Equipments, Limited, Burscough, Lancs, increased by £4,000, in 1,000 ordinary and 3,000 5 per cent. cumulative preference shares of £1 each, beyond the registered capital of £1,000.

A. McPherson & Company (Reading), Limited, engineers, etc., increased by £9,000, in 4,000 ordinary "B" and 5,000 ordinary "C" shares of £1 each, beyond the registered capital of £1,000.

Dacre Chucks, Limited, manufacturers of engineering plant, etc., of Dean Farrar Street, London, S.W.1, increased by £6,000, in £1 preference shares, beyond the registered capital of £1,000.

Hartmann Bros. (Machinery), Limited, St. James's Street, London, S.W.1, increased by £4,000, in 6 per cent. cumulative preference £1 shares (non-redeemable), beyond the registered capital of £1,000.

William Jones, Limited, manufacturers of machinery, rolling stock, etc., of Charlton, London, S.E.7, increased by £25,000, in £1 cumulative preference shares, beyond the registered capital of £35,100.

Lilleshall Company's Activities

"During the year we have been very much involved in negotiations with the National Coal Board with the physical separation necessitated by colliery nationalisation," says Vice-Admiral Earl Granville, chairman of the Lilleshall Company, Limited, in a statement circulated with the annual report. "Our case is rather a complicated one, as not merely were the mines themselves transferred, but a number of service departments, such as railroads, houses, estates, electric supply, canteens, and medical services, etc., have to be divided and separated. With this experience to guide us, and in view of the present Government's policy of nationalisation, your board thought it advisable to divide the company's varied operations into separate administrative units. As a first step they decided to deal with the iron and steel sections, and on December 31, 1947, the Lilleshall Iron & Steel Company was formed as a private limited company with the whole of the capital held by the Lilleshall Company, Limited. If, unfortunately, iron and steel is nationalised, it is hoped that the transfer will become a much simpler and more clear-cut operation than was the case with the collieries."

Festival of Britain, 1951

Lord Ismay has agreed to serve in an honorary capacity as chairman of a Council which is being set up to supervise the arrangements for the Festival of Britain, 1951, which is being held in connection with the celebrations of the centenary of the Great Exhibition, 1851. Mr. Gerald Barry, for many years editor of the "News Chronicle," has been appointed Director-General of the Festival; he will act as chairman of a small Executive Committee composed of senior officers of the Arts Council of Great Britain, the Council of Industrial Design and the Central Office of Information. Mr. Leonard Crainford has been appointed secretary.

The offices of the Festival of Britain, 1951, will be at the Royal Society of Arts headquarters, Adelphi, from which the Great Exhibition of 1851 was organised.

Mr. Herbert Morrison, Lord President of the Council, giving this information recently, said that a further announcement about the Festival, including the composition of the Council and arrangements for Scotland and Wales, would be made in due course.

Swan, Hunter's Prospects

Sir Wigham Richardson, chairman of Swan, Hunter & Wigham Richardson, Limited, reviews shipbuilding conditions and prospects in his statement submitted with the report. He states that production during the year was hindered by the severe winter, the fuel crisis and shortages of material and labour, while the reduction of working hours in the shipyards also retarded production. The company's works and those of its subsidiaries continue to be fully employed, and this favourable state of affairs is likely to continue for the next two years or so, as they have contracts which will keep them well occupied until 1950, and in the case of some contracts even beyond this date.

Gazette

BURLAND ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. R. Horton, 37-38, St. Mary's Gate, Derby, is the liquidator.

MOULDING POWDERS, LIMITED, is being wound up voluntarily. Mr. S. S. Kenyon, 8, Leicester Street, Gate, Derby, is the liquidator.

ROBERT ROWELL & SONS (ENGINEERS), LIMITED, is being wound up voluntarily. Mr. C. W. Wildy, 36, New Broad Street, London, E.C.2, is the liquidator.

SUSSEX PLANT HIRE COMPANY, LIMITED, is being wound up voluntarily. Mr. G. E. Ferguson, White House, Goring-by-Sea, Sussex, is the liquidator.

ROBIN DIE-STAMPING COMPANY, LIMITED, is being wound up voluntarily. Mr. V. C. Baker, 2, Lord North Street, Westminster, London, S.W.1, is the liquidator.

PAPWORTH, LIMITED, precision engineers, etc., of Bristol, is being wound up voluntarily. Mr. P. B. Addington, 19, Coleman Street, London, E.C.2, is the liquidator.

MARSDEN-DAVIES, LIMITED, bolt and nut manufacturers, of Manchester, is being wound up voluntarily. Mr. L. Wise, 37, Cross Street, Manchester, is the liquidator.

STANLEY CROFT, LIMITED, power-transmission engineers, etc., of Birmingham, is being wound up voluntarily. Mr. R. Bromley, 28, Waterloo Road, Wolverhampton, is the liquidator.

THOS. WILLIAMS & SONS (LLANGENNECH), LIMITED, colliery proprietors and firebrick manufacturers, is being wound up voluntarily. Sir Evan Williams and Major T. S. Morris are the joint liquidators.

MR. NORMAN GURNEY RANDALL has been appointed liquidator (with a committee of inspection) for the winding-up of Peter Bassett & Company, Limited, engineers, of High Holborn, London, W.C.1.

THE PARTNERSHIP BETWEEN Denis George Trussell and Arthur Thomas Kirk, carrying on business as light engineers at 3A, Commerce Road, Wood Green, London, N.22, under the style of Trussell & Kirk, has been dissolved.

WHEELER MANUFACTURING COMPANY, LIMITED, manufacturers of dividing heads for milling machines, is being wound up voluntarily. Mr. R. Gwynne, R. Gwynne & Sons, Edgbaston House, Wellington, Shrops, is the liquidator.

THE PARTNERSHIP BETWEEN William Alfred Watson and Arthur Richard Watson, carrying on business as engineers at Bembridge, Isle of Wight, under the style of A. R. Watson & Company, has been dissolved. Debts will be received and paid by A. R. Watson, who continues.

THE PARTNERSHIP BETWEEN Eric Humphrey Pritchard and Francis Martin, carrying on business as heating, hydraulic, sanitary and general engineers, at Bewdley Road and Cobden Street, Kidderminster, under the style of H. E. Pritchard & Son, has been dissolved so far as concerns F. Martin.

THE PARTNERSHIP BETWEEN Arthur John Duncan and Robert Frank Christie, carrying on business as water-supply engineers at 53, Beaconsfield Road, Littlehampton, Sussex, under the style of Duncan & Christie, has been dissolved. Debts will be received and paid by A. J. Duncan, who continues.

THE PARTNERSHIP BETWEEN Alfred William Sharman and Arthur George Ellis, carrying on business as engineers and machine welders at 66, Saint Andrews Road, Northampton, under the style of Sharman & Ellis, has been dissolved. Debts will be received and paid by A. W. Sharman, who continues.

THE PARTNERSHIP BETWEEN George Croall Watson Waite and John Muckalt, carrying on business as general engineers, at Theatre Street, Ulverston, Lancs, under the style of G. W. Waite & Company, has been dissolved. Debts will be received and paid by G. C. W. Waite, who continues.

THE PARTNERSHIP BETWEEN Septimus Harold Ronayne and James Henry Gribby, carrying on business as engineers' agents, at 286B, Arkwright Street, Trent Bridge, Nottingham, under the style of Ronayne & Gribby, has been dissolved. Debts will be received and paid by S. H. Ronayne, who continues.

THE PARTNERSHIP BETWEEN George Carroll and Francis Victor Sharlinski, carrying on business as hollow-ware manufacturers, at 74, Broadwich Street, London, W.1, under the style of G. Carroll & Company, has been dissolved. Debts will be received and paid by G. Carroll, who continues.

New Trade Marks

The following applications to register trade marks appear in the "Trade Marks Journal":—

"REPUBLIC ELECTRUNITE"—Pipes, tubes, etc. REPUBLIC STEEL CORPORATION, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

"BRITISH ARROW"—Aeronautical apparatus, motors and internal combustion engines for land vehicles, etc. ARROW AIRCRAFT, LIMITED, The Aerodrome, Victoria Avenue, Yeadon, near Leeds.

"MOTOBLOC" and "MOTOBLOCK" — Wire-drawing machines (complete). VAUGHAN MACHINERY COMPANY, c/o D. Young & Company, 29, Southampton Buildings, Chancery Lane, London, W.C.2.

"REFLECTAL" — Unwrought and partly-wrought common metals and their alloys. SOCIETE ANONYME POUR L'INDUSTRIE DE L'ALUMINIUM, c/o Gill, Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

MR. W. H. SALMON, of Hadfields, Limited, Sheffield, has removed to 2, Beech Avenue, Gatley, near Manchester, Ches (telephone: Gatley 2142).

MR. G. J. MORGAN, who assumed office as president of the National Association of Drop Forgers and Stampers on March 24, is managing director of George Morgan, Limited, Selly Oak, Birmingham. He succeeds COL. J. W. DANIELSEN, who has retired after three years as president of the association.

MR. E. R. MYERS has retired after 56 years' service with Cochranes (Middlesbro') Foundry, Limited. He began his career as an office boy in 1892 and for the past 30 years he has been in charge of the wages section. Mr. Myers, who is in his 70th year, has received a presentation to mark his retirement.

News in Brief

HENRY ROBB, LIMITED, engineers, shipbuilders and repairers, of Leith, celebrated the thirtieth anniversary of the foundation of the company on April 1.

THE MINISTER OF SUPPLY has asked the Engineering Industries Association to co-operate in an effort to adapt Board of Trade and Ministry of Supply controls "to present needs."

THE FORMER British India troopship Nevasa has arrived at the Bridgeness yard of P. & W. MacLellan, Limited, to be broken up on behalf of the British Iron & Steel Corporation, Limited.

THE ROYAL NETHERLANDS BLAST FURNACES & STEEL FOUNDRIES has been placed by Lloyd's Register of Shipping on the list of steel factories to make steel suitable for the shipbuilding industry.

A NEW METHOD of producing tubing from steel strip at the rate of 100 ft. a minute, compared with about 12 ft. a minute by the drawing and annealing method, has been devised, it is claimed, by Major L. B. Henderson, formerly technical adviser to Tube Investments, Limited.

ORDERS FOR six cargo vessels of 10,750 tons d.w. each have been placed by Ellerman Lines, Limited. Two vessels each will be built by Cammell Laird & Company, Limited, Birkenhead, William Denny & Bros., Limited, Dumbarton, and Alexander Stephen & Sons, Limited, Glasgow.

WILLIAM GRAY & COMPANY, LIMITED, West Hartlepool, which recently launched a 3,400-ton cargo steamer for Danish owners, has received a repeat order for two vessels of similar size. One of these will be an oil-fired steamer and the other a motor ship, and both are to be delivered about the end of next year.

NEGOTIATIONS between the Treasury and the Singer Manufacturing Company, New Jersey, have resulted in a temporary agreement being reached in regard to the proceeds of the company's Clydebank factory's output in hard-currency areas being retained for use by the British Government. Discussions are being continued, and it is hoped that a permanent solution will be found before the present agreement is due to expire.

THE BOARD OF TRADE states that the arrangements announced in September, 1947, in connection with the restoration of tung oil (china wood oil) to private trade are to remain in operation until further notice, except that as from April 1 persons desiring supplies of this material may submit import-licence applications in respect of twice the amount of oil purchased from the Board of Trade on and after that date.

THE TEES AND HARTLEPOOL DISTRICT of the Confederation of Engineering and Shipbuilding Unions has decided to press for a continuous five-day week in the shipyards throughout the year, in place of the present arrangement under which a 5½-day week is worked during the winter months. It has also been decided to seek an agreement for lost-time payments to workmen suffering from the effects of electric-welding flash.

Debenture Quotation for Ransomes & Rapier

Quotation has now been granted by the London Stock Exchange for the issue of £200,000 3½ per cent. first mortgage debenture stock of Ransomes & Rapier, Limited, engineers and ironfounders, etc., of Ipswich. The issue, in part, results from a conversion of the outstanding 4 per cent. stock, of which £79,771 was outstanding to be redeemed. The greater part, however, is new permanent capital raised to finance "the further increase in the scale of the company's operations." Conversion was on a £1 for £1 nominal basis, with a cash payment of £3, being the difference between 101, the redemption price of the old stock, and 98, the issue price of the new. The new stock carries redemption dates 1958-83 at par, and provision is also made for annual drawings at par by a 1½ per cent. cumulative sinking fund.

Coghlan Steel & Iron Company

As from April 1, the business of the Coghlan Steel & Iron Company, Limited, Leeds, was transferred entirely to two new companies, to be known as Coghlan Bright Steel, Limited, and Coghlan Forge & Rolling Mills, Limited, which will be subsidiary companies of the Coghlan Steel & Iron Company. Coghlan Bright Steel will take over the obligations and benefits of all contracts and engagements of that part of the Coghlan Steel & Iron Company concerned with the manufacture of bright-turned, ground and drawn steel, and Coghlan Forge & Rolling Mills will take over the obligations and benefits of all contracts and engagements of that part of the Coghlan Steel & Iron Company concerned with the re-rolling of steel, etc., and the manufacture of black steel, sheets and forgings.

Stocks and Sales of Non-ferrous Scrap

The Ministry of Supply announces that the stock of non-ferrous scrap on charge on February 29 was 46,728 tons, made up as follows:—S.A.A. cases, 3,249 tons; copper and copper alloy, 12,638; zinc and zinc alloy, 6,459; lead, 5,692; other grades, 18,690 tons.

Sales for the two months' period January-February amounted to 17,911 tons (approximate value £1,500,000). The analysis was as follows:—S.A.A. cases, 4,580 tons; copper and copper alloy, 4,475; zinc and zinc alloy, 995; lead, 5,275; other grades, 2,586 tons.

Material put out to tender during the period amounted to 6,732 tons, of which 5,395 tons were lead. During the January-February period, 12,512 tons were invoiced, the value being £1,135,583.

Malayan Tin Prices

The Ministry of Supply has announced adjustments in the buying and selling prices for Malayan tin metal, which will operate as from yesterday (Wednesday). The buying price for Malayan metal is adjusted from £500 to £504, and the selling price from £504 to £505 10s., both per ton, ex smelter (Penang or Singapore).

Company News

(Figures for previous year in brackets.)

C. & W. Walker—Dividend of 10% (same) and bonus of 5% (2½%).

Dunswart Iron & Steel Works—Interim dividend of 6% (same) in South African currency.

Midland Bright Drawn Steel & Engineering Company—Interim dividend of 20% (same).

B. O. Morris—Final dividend of 30%, making 50%. The company was made public in June, 1947.

Robert Stephenson & Hawthorns—Dividend of 5% (same) and bonus of 2%, less tax (2%, tax free).

Blaw-Knox—Final dividend of 20%, making 30%. The company was made public in November, 1947.

Newton, Chambers & Company—The directors propose a capital cash bonus of £60,403, being net capital appreciation on shares sold prior to 1943.

Joseph Lucas—Interim dividend of 5% (2½%). The increased interim payment is not to be taken as an indication of an increased total for the year.

Engineers & Ironfounders—Profit for 1947, £5,139 (£5,571); final dividend of 15% (12½%) and bonus of 12½% (7½%), making 32½% (22½%); forward, £6,072 (£7,847).

Thos. Firth & John Brown—Second interim dividend of 7½%, free of tax, on account of 1947. It is not intended to recommend any further dividend for the year. With the first interim dividend of 2½%, tax free, therefore, the 1947 distribution is 10% net, as paid in 1946.

Coley Metals—Net profit for the year to January 31, 1947, £19,443, after taking into account £5,500 from subsidiary and £14,247 provision for subsidiary's losses to January 31, 1946, written back; to interim dividend of 10%, £5,500; credit balance forward, £4,727 (debit £9,216).

Lilleshall Company—Trading profit, etc., for 1947, £88,345 (£36,028); to directors' fees, £1,400 (£1,381); tax, £29,480 (nil); pension fund, £1,474 (£1,681); profit, £55,991 (£32,966); dividend of 40% (20%); additional preference dividend of 4% (2%); forward, £96,712 (£73,271).

Davies & Metcalfe—Net trading profit for 1947, after expenses, depreciation and taxation, £16,199 (£13,900); final dividend of 12%, making 15% (11%); written off land and buildings, £2,931 (off goodwill, £4,999); to general reserve, £2,500 (£2,000); forward, £7,310 (£4,259).

Midland Electric Manufacturing Company—Net profit for 1947, after tax, etc., £53,160 (£59,066); interest on tax certificates, £1,202 (£945); to general reserve, £21,000 (£20,000); development reserve, nil (£5,000); dividend of 20% and bonus of 15% (same); forward, £40,122 (£38,729).

Worthington-Simpson—Trading profit, less profits tax, for 1947, £209,949 (£151,475); to depreciation, £19,580 (£16,163); directors' fees, £1,200 (same); debenture interest, £4,444 (same); premiums, £8,271 (£7,544); net profit, £176,454 (£122,124); to income tax, £79,000 (£58,000); general reserve, £50,000 (£25,000); dividend of 20% (same); forward, £42,516 (£33,521).

Parker, Winder & Achurch—Net profit for 1947, after deferred repairs, taxation, etc., £49,314 (£28,966); surplus on sale of investments and property, nil (£1,325); dividend of 15% (10%) and bonus of 20% (10%); to general reserve, £5,000 (same); pensions, £8,912 (£7,500); dividend equalisation reserve, £5,000 (same); investment reserve, £3,000 (nil); forward, £42,533 (£31,450).

Millom & Askam Hematite Iron Company—Trading profit for 1947, £148,967 (£74,234); other income, £283 (£7,058); to debenture interest and redemption fund, £6,038 (£11,961); directors' remuneration, £2,742 (£2,445); reserve for taxation, £45,000 (nil); net profit, £95,470 (£66,885); written off fixed assets, £20,000 (£10,000); to reserve, £7,764 (nil); dividend of 10% (same); forward, £57,899 (£46,798).

Gibbons (Dudley)—Net profit for 1947, after taxation and depreciation, £48,221 (£43,688); to general reserve, £5,000 (same); works reconstruction and modernisation, £15,000 (same); buildings and kilns, £3,000 (same); dividend equalisation fund, £1,322 (£3,678); employees' benefit fund, £5,517 (£3,678); final dividend of 2½%, making 10% (same) and a bonus of 7½% (5%); forward, £23,588 (£21,079).

Valor Company—Trading profit for 1947, after tax, £59,497 (£47,324); capital assets profit, £160 (£537); interest, £35 (£287); fees, £43 (£61); rent, £84 (£62); to depreciation, £16,607 (£7,149); debenture interest, £500 (£5,568); debenture redemption fund, nil (£2,544); debenture redemption premium, £2,403 (£251); dividend of 15% (same) and bonus of 5% (nil); to general reserve, £10,000 (£7,662); forward, £19,433 (£16,624).

A. H. Hunt—Trading profit for the period from December 30, 1946, to December 20, 1947, £119,323; to directors' remuneration, £12,972; fixed assets depreciation, £8,979; auditors' fees, £315; profits tax, £12,750; income tax, £42,005; profits prior to incorporation (less tax, £25,804), £21,089; dividend for six months at the rate of 22½% per annum (11¼% actual); forward, £13,479. The company was made public in July of last year.

William Gray & Company—Trading profit for 1947, £308,237 (£264,495); interest and dividends, £2,248 (£4,946); rents, £1,129 (£1,320); taxation of previous years, £69,748 (nil); to depreciation, £63,002 (£53,771); directors' fees, £1,750 (same); tax, £157,177 (£172,544); net profit, £159,433 (£42,696); to reserve fund, £15,000 (£10,000); deferred repairs, £50,000 (£10,000); written off Tees and Wear yards, £75,107 (nil); dividend of 2½% (same); forward, £9,810 (£11,109).

C.V.A. Jigs, Moulds & Tools—Net trading profit for 1947, before depreciation, £122,240 (£76,197); profit on sale of land and buildings and investment income, £6,010 (£4,970); to directors' fees, £1,300 (£304); depre-

ciation, £40,119 (£38,815); taxation, £50,414 (£22,288); profit, £36,417 (£19,760); to dividend on "A" ordinary shares, £4,950 (same), and on "B" ordinary shares, £1,650 (equivalent to 6% same); general reserve, £20,000 (nil); capital reserve, nil (£2,827); forward, £17,030 (£13,263).

Expanded Metal Company—Trading profit for 1947, £140,833 (£75,809); other income, £1,423 (£1,170); to directors' fees, £5,792 (£5,074); depreciation, £6,533 (£4,510); profits tax, £17,300 (£3,260); income tax, £49,420 (£13,440); future tax provision, £49,000 (£27,100); written off goodwill, etc., nil (£31); net profit, £63,211 (£45,621); to general reserve, £25,000 (£10,000); dividend equalisation, £15,000 (nil); contingencies, nil (£14,000); off preference issue expenses, £324 (nil); final dividend of 14½%, making 22½% (same); forward, £30,474 (£25,949).

Swan, Hunter & Wigham Richardson—Profit for 1947, including interest, after providing for taxation, £333,351 (£273,800); dividends, less tax, from subsidiary companies, and other investments, £119,532 (£121,316); transfer fees, £197 (£215); surplus on realisation of investments, nil (£18,483); to directors' fees, £1,775 (£1,950); depreciation, £55,989 (£53,586); net profit, £395,316 (£358,278); dividend and bonus of 16% (same); to reserve, £100,000 (same); written off goodwill, £75,000 (same); pension account, £25,000 (nil); forward, £83,863 (£65,186).

British Aluminium Company—Trading profit for 1947, including income from group companies, after reserve for fluctuations in stock, £2,118,153 (£1,364,412); interest and dividends on investments, £4,564 (£3,145); fees, £630 (£538); to directors' fees, £19,138 (£20,750); profits tax, £239,000 (nil); income tax, £864,000 (£455,000); additional tax on reduction of E.P.T. in respect of deferred repairs, nil (£130,000); debenture interest, £129,780 (nil); debenture service fund, nil (£175,000); depreciation, £225,000 (£140,000); amortisation of leases, £42,587 (nil); deferred repairs, £150,000 (nil); general reserve, £200,000 (same); staff superannuation fund, £15,000 (£10,000); leaving available, £238,842 (£237,345); to preference dividend, £90,000 (same); final ordinary dividend of 6%, making 10% (same); forward, £332,703 (£308,361).

International Nickel Company of Canada—Statement of consolidated profit and loss for 1947 shows net sales, $166,362,873 ($133,114,941); to costs and expenses, $102,920,920 ($84,797,936); operating profit, $63,441,953 ($48,317,005); other income, $1,120,924 ($1,314,399); to depreciation and depletion, $7,633,460 ($7,089,057); retirement system, $2,945,783 ($2,614,464); contingencies, $3,000,000 (nil); taxes based on income (including $12,861,440 reserved for Canadian taxes), $17,480,168 ($10,246,531); net profit, $33,503,466 ($29,681,352); earned surplus at the beginning of the year, $87,105,510 ($82,683,127); making, with net profit, $120,608,976 ($112,364,479); preferred dividends, $1,933,899; common dividends, $29,156,338 ($23,325,070); earned surplus, end of year, $89,518,739 ($87,105,510). Sales of nickel totalled 205,278,868 (201,103,234) lb. and of copper 220,671,157 (149,777,060) lb.

Obituary

MR. ALEXANDER JOHN GELLATLY, formerly of the Edison Swan Electric Company, Limited, has died at Edinburgh.

MR. W. G. HAYWOOD, managing director of Haywood Foundries, Limited, Hampstead Road, London, N.W.1, died recently at the age of 71.

MR. ROBERT SHEARER ANDERSON, who died on March 27, was managing director of Marshall, Fleming & Company, Limited, crane manufacturers, of Motherwell.

MR. LEONARD HARDISTY, of West Bromwich, who for many years was secretary of the central branch of the National Union of Foundryworkers, has died at the age of 56.

MR. WALTER RUSSELL BAKER, who has died at the age of 88, had been associated with Cyrus Price & Company, Limited, safemakers, etc., of Wednesfield, for 71 years. He had been managing director of the company since 1895.

MR. OLIVER LUCAS, who has died suddenly at Nassau, in the Bahamas, was joint managing director of Joseph Lucas, Limited, manufacturing electrical engineers, of Birmingham. Born in 1892, he was a grandson of the founder of the firm. Mr. Lucas was chiefly responsible for promoting the large-scale manufacture of fuel injection pumps in this country, while in 1940 he began to take an active part in the experimental work on the gas turbine engine. In the second world war he was appointed Director of Research and Development at the Ministry of Supply, where his main concern was the overhauling of tank design and the production of the fast cruiser tank.

Uniform Prices for Drop Forgings

Speaking at the annual meeting of the National Association of Drop Forgers and Stampers at Birmingham last month, Col. J. W. Danielsen, the retiring president, gave a warning that, unless members adopted a system of uniform prices, it might be the last opportunity the industry would have for stabilising prices on sound, efficient lines. Already, he said, some members were deriving benefit from uniform prices, but the support of the whole body of members was required, particularly in view of the present trend of the commercial market.

John Brown Group Withdraws from N. Rhodesia Pig-iron Scheme

Thos. Firth & John Brown, Limited, Sheffield, has withdrawn its support for the scheme to produce pig-iron in Northern Rhodesia, which envisaged an annual production of 500,000 tons. An official of John Brown & Company, Limited, the parent company, would give no reasons for the withdrawal, but he said that the company was still very interested in Southern Rhodesia. It had obtained a substantial interest in the firm of F. Issels, general engineers, of Bulawayo.

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Milvan Tools—£4,000. H. Milnes, 136, Blair Athol Road, Sheffield.

James Best, Engineers, Front Row, Holbeck, Leeds—£3,000. J. W. and W. R. Best.

Bromford Iron Company, Bromford Lane, West Bromwich—£20,000. J. Ashmore.

P. & S. Engineers (Components), 25, Cardiff Road, Luton—£1,000. C. O. Pilbeam and G. Swan.

H. Roberts & Son (Sheffield), 70, Archer Lane, Millhouses, Sheffield—Ironfounders, etc. £1,000.

Horsforth Ganister Company, 10, Clarendon Road, Leeds—£1,000. F. Whitaker and W. Armitage.

Harry Burnley (Brassfounders), Norcroft Foundry, Listerhills, Bradford—£5,000. E. and A. Burnley.

Southern Metal Industries, 1-4, The Strand, Southampton—£5,000. E. C. Cannon and V. G. Wilkins.

Maestro Welding Company, Ibex House, Minories, London, E.C.3—£1,000. C. R. W. and R. G. Sims.

Harry Burnley (Ironfounders), Norcroft Foundry, Listerhills, Bradford. £10,000. E. and A. Burnley.

Frank Berry, Prudential Chambers, Grey Friars, Leicester—Scrap-iron merchants. £6,000. F. Berry.

Wallace Engineering Supplies, 44, Brazennose Street, Manchester—£1,000. M. P. Rubert and K. Wallace.

Samuel Davies, 35, Gravel Lane, Salford—Electro, nickel and chromium platers, etc. £5,000. S. Davies.

Henry Hirst (Sheffield), The Hirst, Wadsley Bridge, Sheffield, 6—Engineers, etc. £5,000. H. and E. Hirst.

London Metal Treatment Company—£1,000. W. D. Waller, 34, Redbridge Lane, Wanstead, London, E.11.

Mills Products, 1-3, Chilworth Mews, Paddington, London, W.2—General engineers. £5,000. R. C. Mills.

Gravely Overseas, 63-5, Piccadilly, London, W.1—Manufacturers of agricultural machinery, etc. £10,000.

Marine & Engineering Supplies (Liverpool), 45, Regent Road, Liverpool—£2,000. J. A. and A. Ross.

Bates Bros. (Sheet Metal Workers), 36, Mulberry Street, Hulme, Manchester—£2,000. W., A. and A. P. Bates.

Castle Patternmaking Company, 25, Clinton Lane, Kenilworth, Warwicks—£2,000. W. R. and D. A. Taylor.

Russell Engineering Company, 9, Russell Road, Croydon—£1,000. E. F. Clapson, P. E. Hobbs and A. F. Powell.

Turnscrews, 4, Arundel Street, Strand, London, W.C.2—Precision engineers and manufacturers, etc. £60,000.

C. S. Phillips, Park Lane Steelworks, Oldbury, Worcs—Die-casters, engineers, etc. £3,000. C. S. and L. Phillips.

Superstat, 155, Minories, London, E.C.3—Water supply engineers, etc. £10,500. A. F. C. Timpson and S. C. Osborne.

Kimberley Industries, 53, Victoria Street, London, S.W.1—Iron and brass founders, engineers, etc. £1,000. C. E. Le Grice.

Yorkshire Range Company, 32, Otley Road, Shipley, Yorks—Ironfounders, etc. £10,000. R. L., D. W. F., and A. Rogerson.

Fine Engineers (Northern), 13, Waterloo Road, Bramhall, Stockport—£1,000. J. B. Longhorn, R. S. Fairfax, and A. McDowell.

Tabra, 83, Colmore Row, Birmingham—Ironfounders, engineers, etc. £1,000. D. C. Stevens, L. R. James, and A. Hunt.

A. & H. Hall (Engineers), Holmshaw Yard, Holmshaw Road, Lower Sydenham, London, S.E.26—£1,000. A. H. and H. E. Hall.

William Hampson (Oldham), Lyon Works, Werneth, Oldham—Engineers, etc. £5,000. Sir J. and W. A. Dodd, and J. J. Jepson.

Murlaston Engineering Company, 57, Stanwick Mansions, W. Kensington, London, W.14—£1,000. J. F. Laskey and W. A. Stone.

Gil & Green, 31, Lincoln Road East, Peterborough—Agricultural and general engineers, etc. £4,000. A. and J. V. Gil, and A. R. Green.

H. Jay-Coward, Monksdale Road, Oldfield Park, Bath—Mechanical and general engineers, etc. £20,000. H. Jay-Coward, and L. and J. Coward.

J. Lassam & Company, Trading Estate, Treforest, Glam—Brass, aluminium and ironfounders, etc. £10,000. A. J. Nicholas and J. P. Gilliver.

T.M.M. Engineering (Gloucester), Twyver Works, Millbrook Street, Gloucester—£3,000. G. S. Nott, H. Beesley, R. G. N. Harris and J. H. M. Davoile.

Western Steel Casting & Engineering Company, 3, Woodstock Road, Chiswick—Manufacturers of safety devices for use in mines, etc. £1,000. A. Dearnley.

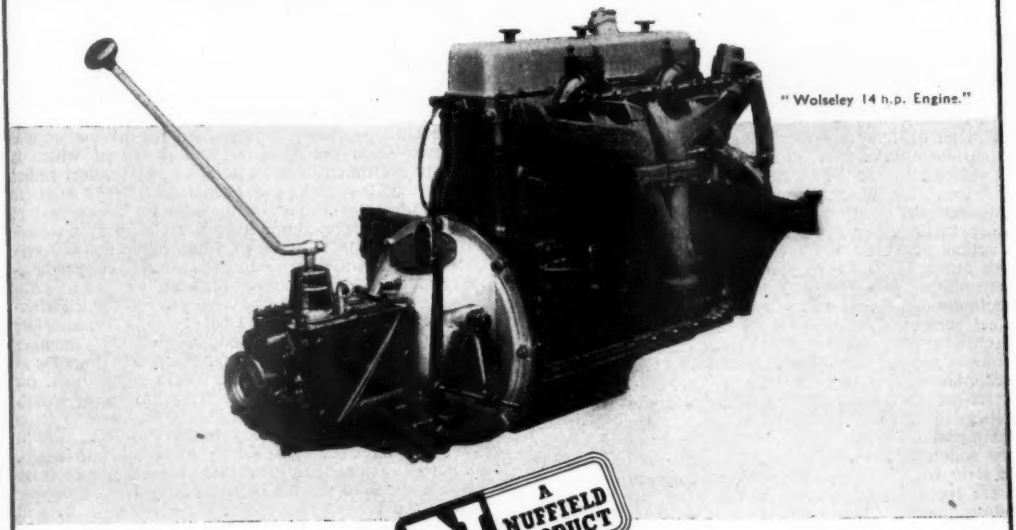
Langleys (Woore), 25, Penkhull Street, Newcastle-under-Lyme, Staffs—Agricultural machinery manufacturers. £5,000. E. Bloor, F. Langley, and K. S. Barton.

Stafford & Moffitt, 203, Loughborough Road, West Bridgford, Notts—Marine, mechanical and general engineers, etc. £15,000. W. W. Stafford and E. W. Moffitt.

Howard & Pepperell, Imperial Buildings, Bridge Street, Walsall. Scrap metal merchants, etc.—£3,000. J. Howard, H. J. Pepperell, F. W. G. Church, and L. Bramhall.

Goddard & Stevenson, 19, Great Winchester Street, London, E.C.2—Manufacturers of agricultural machinery, etc. £1,000. E. Goddard, R. V. Stevenson, and T. C. Kirby.

Carlannder Products, Craghall Dene, South Gosforth, Newcastle-upon-Tyne—Manufacturers of cooking and heating stoves, etc. £2,000. C. T. Borch, E. L. James, and J. Baum.



A NUFFIELD PRODUCT

Using

STANTON-DALE

REFINED PIG IRON

USED AND RECOMMENDED
FOR ALL HIGH-DUTY
ENGINEERING CASTINGS

THE STANTON IRONWORKS COMPANY LIMITED, Nr. NOTTINGHAM

Raw Material Markets

Iron and Steel

Output of pig-iron is well maintained, with a considerable increase in the production of basic iron for steelmaking. The position in respect to foundry iron, however, is unchanged, and bigger supplies are urgently needed. All foundries are very busy and the light foundry trade is in particularly urgent need of additional supplies of high-phosphorus iron; some foundries are still finding it difficult to get the limited tonnages allocated by the Control. Engineering foundries are very active, being engaged not only on the production of essential high-duty castings for P.M.L. work, but also on the production of castings for machinery, etc. These users are procuring reasonable supplies of low- and medium-phosphorus iron, hematite and refined pig, but are still incommoded through the lack of suitable cast-iron and steel scrap. Requirements in limestone and ganister, firebricks, etc., are being met satisfactorily, and cupola coke is arriving from the Durham and Welsh ovens in accordance with the current schedule.

Re-rollers still lack adequate supplies of small billets, and there is a particular dearth in available quantities of 2-in. to 3-in. square and flat billets for the rollers of strip. The re-rollers of heavy sizes, both of strip and bars, are in a somewhat better position, as there have been increased deliveries of heavy billets, blooms, and slabs, and this position is likely to be maintained. All works have heavy order-books, particularly the strip mills, while sheetmakers are also overloaded and heavy tonnages of sheet bars are essential. In the meantime the best possible use is being made of steelworks' arisings of defective sheet bars, billets, crops, etc., and re-rollers are still using limited quantities of electrically-melted steel, some of which is being used for export orders. There is, too, a considerable amount of export business in hand in bars and strip. There is no free tonnage for abroad and most of the present business is through Government bilateral agreements; a considerable quantity of the orders on hand is for the Scandinavian market.

Non-ferrous Metals

Last week was noteworthy for a number of price changes, none of them far reaching in its effect on the general situation, but all calculated to act as a reminder that, even in these days of bulk purchasing and control, alterations in value can, and do, take place. In New York the export price of copper, which for a month past had stood at 22 cents, f.a.s., dropped first to 21.87 cents and then to 21.75 cents, with a recovery to 21.87 cents before the week came to an end. Then on March 31 the Ministry of Supply announced an alteration in the price of Malayan tin. Negotiations in regard to Malayan metal have been going on for a long time, so that some announcement was anticipated. Yet another alteration related to copper in this country, for the Ministry withdrew its buying prices for rough copper and, as from April 1, substituted a lower figure, *viz.*, £105 for minimum 97.25 per cent. metal and £106 10s. for 99 per cent. and over. These revised figures represented a drop of £6 per ton and were interpreted rather bearishly by some sections of the trade. Since this rough copper is sent for conversion into electro, the explanation probably is that the overall costs of the operation, including transport charges, have increased to a point when some change has become necessary. Consumers of blister copper purchased from the Ministry, the purity of which is probably not much over 99 per cent., will reflect rather ruefully that they must pay £128 10s. in order to cover their requirements. This is the kind of anomaly that crops up when free competition is replaced by a monopoly. It remains to be seen what effect the Government's action will have upon the value of copper-bearing residues. A fall seems pretty certain.

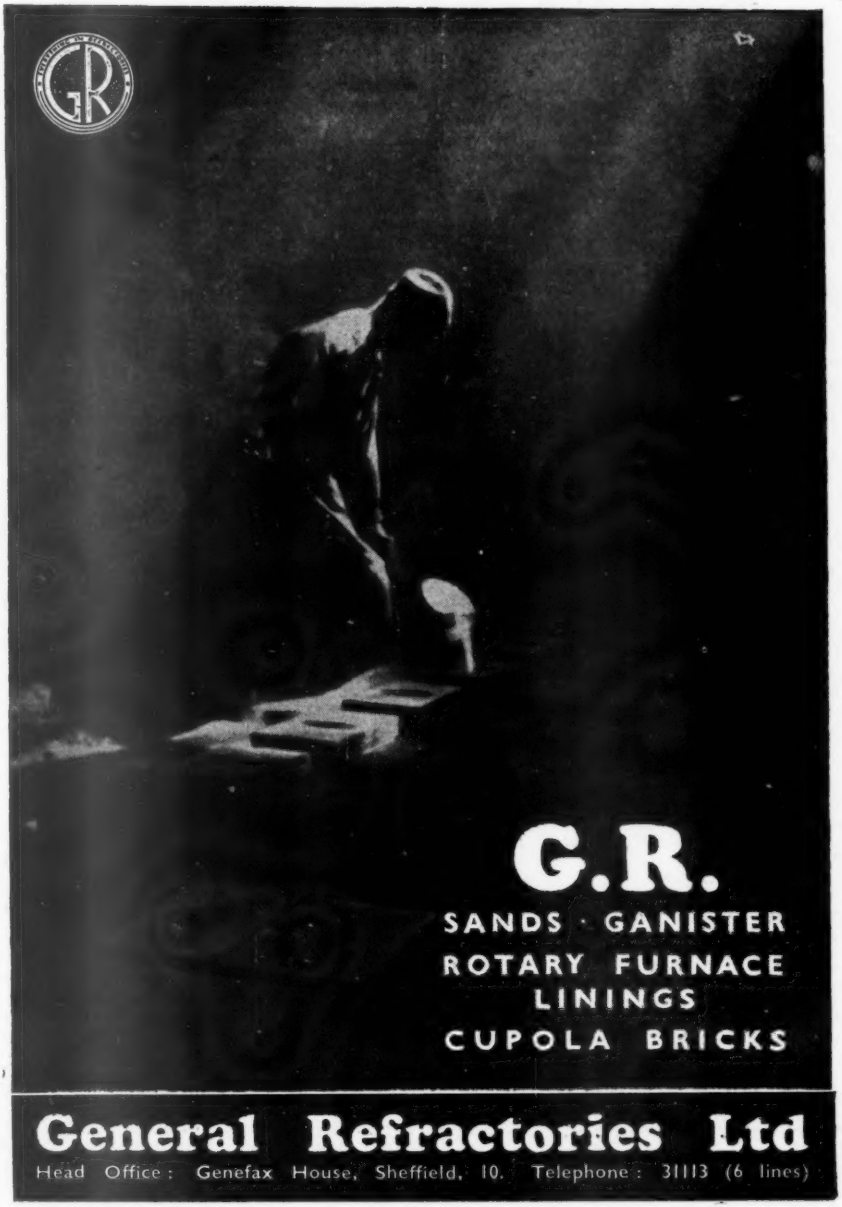
Trading conditions have been very quiet, for the aftermath of Easter was intensified by the uncertainty attaching to Tuesday's Budget, not to mention the serious international outlook. One bright spot was the virtual certainty that E.R.P. would go through, for this measure should permit of freer buying of metals both in Britain and on the Continent. Business in scrap was quieter than for a very long time past, and it may be a week or two before this picks up again. From time to time one hears the suggestion that there will be a check to the really remarkable rate of copper usage in the United States, but the months go by and no deterioration takes place. Foreign copper is, of course, being freely imported to bridge the gap between domestic production and consumption, and it must not be forgotten that stock-piling by the Government is now an integral part of the situation across the Atlantic. At the same time, there is no reason to think that the American authorities would allow their stock-piling activities to prop the market up in the face of a downward trend.

Metal Industries Acquires Engineering Company

Metal Industries, Limited, Glasgow, has acquired over 98 per cent. of the issued share capital and funding certificates of Fawcett Preston & Company, Limited, sugar-machinery manufacturers, etc., of Bromborough Port, Ches, as a result of a formal offer made recently. Mr. J. S. Hutchison and Mr. J. G. R. Woodvine have been appointed directors of Fawcett Preston & Company, representing Metal Industries.

F. & M. SUPPLIES, LIMITED, 4, Broad Street Place, London, E.C.2, has appointed O'Neill & Company, 77, Cannon Street, E.C.2, as sole agents for the sale of the company's products in London and the Home Counties.

THE IMPERIAL WORKS of D. G. Hall & Company, Limited, Newport (Mon), has been purchased as a going concern by Thos. W. Ward, Limited, Sheffield. The works have been operated for some years on the building and repair of railway wagons.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General Refractories Ltd
Head Office: Genefax House, Sheffield, 10. Telephone: 31113 (6 lines)

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Current Prices of Iron, Steel and Non-ferrous Metals

(Delivered, unless otherwise stated)

April 7, 1948

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, £9 13s. 9d.; Birmingham, £9 12s. 3d.; Falkirk, £9 16s. 6d.; Glasgow, £9 19s. 6d.; Manchester, £9 15s. 3d. DERBYSHIRE No. 3: Birmingham, £9 12s. 3d.; Manchester, £9 15s. 3d.; Sheffield, £9 9s. 9d. NORTHANTS No. 3: Birmingham, £9 9s. 9d.; Manchester, £9 13s. 9d. STAFFS No. 3: Birmingham, £9 12s. 3d.; Manchester, £9 15s. 3d. LINCOLNSHIRE No. 3: Sheffield, £9 9s. 9d.; Birmingham, £9 12s. 3d.

(*No. 1 foundry 5s. above No. 3. No. 4 forge* 1s. 6d. *below No. 3 for foundries*, 3s. *below for ironworks.*)

Hematite.—Si up to 3 per cent., S & P over 0.03 to 0.05 per cent.: N.-E. Coast and N.-W. Coast of England, £9 19s.; Scotland, £10 5s. 6d.; Sheffield, £10 11s. 6d.; Birmingham, £10 17s. 6d.; Wales (Welsh iron), £9 19s.; East Coast hematite No. 3, delivered Birmingham station, £10 16s. 6d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. ? £9 19s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, £9 12s. 9d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £11 9s. 6d.; South Zone, £11 12s.

Refined Malleable.—North Zone, £11 19s. 6d.; South Zone, £12 2s.

Cold Blast.—South Staffs, £15 2s. 3d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (6-ton lots).—20/25 per cent., £22 10s.; 40/45 per cent.; £28; 70/85 per cent., £42 15s.

Ferro-vanadium.—35/50 per cent., 15s. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 5s. 8d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 10d. lb.

Tungsten Metal Powder.—98/99 per cent., 10s. 10d. lb.

Ferro-chrome.—4/8 per cent. C, £60; max. 2 per cent. C, 1s. 4d. lb.; max. 1 per cent. C, 1s. 4½d. lb.; max. 0.5 per cent. C, 1s. 4½d. lb.

Cobalt.—98/99 per cent., 10s. lb.

Metallic Chromium.—96/98 per cent., 5s. lb.

Ferro-manganese.—78/98 per cent., £21 3s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £13 17s. 6d.; tested up to 0.25 per cent. C, £14 2s. 6d.; hard (0.42 to 0.60 per cent. C), £15 10s.; silico-manganese, £20 2s. 6d.; free-cutting, £16 12s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £18 2s. 6d.; case-hardening, £19; silico-manganese, £20 2s. 6d.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £15 15s.; basic, hard, 0.42 to 0.60 per cent. C, £16 7s. 6d.; acid, up to 0.25 per cent. C, £19.

Sheet and Tinplate Bars.—£13 7s. 6d.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £18 8s.; boiler plates (N.-E. Coast), £19 5s. 6d.; chequer plates (N.-E. Coast), £19 18s.; angles, over 4 un. in., £17 13s.; tees, over 4 un. in., £18 13s.; joists, 3 in. × 3 in. and up, £17 13s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £18 13s. (d/d Midlands); rounds, under 3 in. to ⅝ in. (untested), £20 5s.; flats, over 5 in. wide, £18 3s.; flats, 5 in. wide and under, £20 5s.; rails, heavy, f.o.t., £16 13s., hoops, £21; black sheets, 17/20 g. (4-ton lots), £25 1s.

Tinplates.—I.C. cokes, 20 × 14, per box, 37s. 0½d., f.o.t. makers' works.

NON-FERROUS METALS

Copper.—Electrolytic, £132; high-grade fire-refined, £131 10s.; fire-refined of not less than 99.7 per cent., £131; ditto, 99.2 per cent., £130 10s.; black hot-rolled wire rods, £138.

Tin.—99 to under 99.75 per cent., £519; 99.75 to under 99.9 per cent., £522 10s.; min. 99.9 per cent., £527.

Zinc.—G.O.B. (foreign) (duty paid), £75; ditto (domestic), £75; "Prime Western," £75; refined and electrolytic, £75 15s.; not less than 99.99 per cent., £77 5s.

Lead.—Good soft pig-lead (foreign) (duty paid), £90; ditto (Empire and domestic), £90; "English," £91 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £87; rolled zinc (boiler plates), ex works, £85; zinc oxide (Red Seal), d/d buyers' premises, £73.

Other Metals.—Aluminium, ingots, £82 10s.; antimony, English, 99 per cent., £180; quicksilver, ex warehouse, £16; nickel, £195.

Brass.—Solid-drawn tubes, 21½d. per lb.; brazed tubes, 25d.; rods, drawn, 18½d.; rods, extruded or rolled, 15½d.; sheets to 10 w.g., 17½d.; wire, 18½d.; rolled metal, 16½d.; yellow metal rods, 16½d.

Copper Tubes, etc.—Solid-drawn tubes, 22d. per lb.; wire, 149s. 6d. per cwt. basis; 20 s.w.g., 178s. 6d. per cwt.

Gun Metal.—Ingots to B.S.S. 897 (85/5/5/5), £106 to £115; B.S.S. 1023 (86/7/5/2), £116 to £124 10s.; Admiralty, B.S.S. 382 (88/10/2), £159 to £180, per ton, ex works.

Phosphor-bronze Ingots.—2B8, £168 to £185; B.S.S. 1060, £126 to £138 per ton.

Phosphor Bronze.—Strip, 24½d. per lb.; sheets to 10 w.g., 26½d.; wire, 26½d.; rods, 25½d.; tubes, 29½d.; chill cast bars: solids, 2s. 1½d., cored, 2s. 2½d.; 10 per cent. phos. cop., £165 10s.; 15 per cent. phos. cop., £171; phosphor tin (5 per cent.), £566. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 1s. 5½d. per lb. (7%) to 2s. 0½d. (30%); rolled metal, 3 in. to 9 in. wide, × .056, 1s. 11½d. (7%) to 2s. 6½d. (30%); to 12 in. wide, × .056, 2s. to 2s. 7d.; to 25 in. wide, × .056, 2s. 2d. to 2s. 9d. Spoon and fork metal, unsheared, 1s. 10½d. to 2s. 5½d. Wire, 10g., in coil, 2s. 4½d. (10%) to 3s. 0½d. (30%). Special quality turning rod, 10%, 2s. 3½d.; 15%, 2s. 7½d.; 18%, 2s. 11½d.